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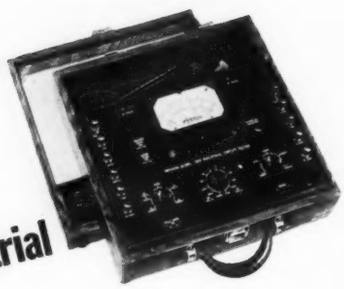

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LOAN TO BRITAIN

. . . *Investment in World Economic Unity*

CONGRESS should give swift and confident approval to the proposed loan to Great Britain.

Few other issues of foreign policy in the present troubled world lend themselves to such clear appraisal of where our National interest lies.

In simplest terms, the question is whether we should extend to Great Britain a credit of $3¾ billions (plus $650 millions in payment for lend-lease balances) in return for her promise to repay principal with interest over a fifty year period starting at the end of 1951, and her pledge to give the fullest possible support to the kind of world trading system which it is the declared policy of both the United States and the United Nations Organization to promote.

We Can Afford to Make It

The sum we hazard is not inconsiderable, but financial risks have meaning only when related to resources. The line of credit provided by the loan will amount, at most, to a claim on 2/5 of 1 per cent of our gross output for the five to six year period over which it may be used. The interest rate charged, while moderate, is higher than our Treasury is paying upon current borrowings. The risk entailed is well within our resources as a creditor. In the considered judgment of the American and British technical experts who thrashed through the intricate accounting for three painful months, the amount and terms offered will suffice to allow Britain, under rigid austerity, to relax her system of foreign trade restrictions, and to expand exports sufficiently to pay her debt commitments.

Against the considered risks of extending the loan, there must be weighed the certain costs of refusing it. Without the loan, Britain has no recourse but to maintain and extend the system of bloc trading which she adopted under stress of world depression and world war. If that is the route Britain follows, she will carry with her a large part of the sterling area countries — all British Commonwealth and Empire countries (except Newfoundland and Canada) plus Egypt, Iraq, and Iceland—and many of the nations with which the United Kingdom has payment agreements (Argentina, Bolivia, Brazil, Chile, Paraguay, Peru, Uruguay, Belgium, Czechoslovakia, Denmark, Finland, France, Netherlands, Norway, Portugal, Spain, Sweden, and Turkey).

Altogether, the United Kingdom's orbit accounts for more than half of the world's imports and exports combined. It likewise is crucial to the trade of the United States. In the years immediately preceding the war, the sterling area and payment-agreement countries provided just under one-half of both the import and export trade of this country.

Russia, of course, will continue to conduct her foreign commerce exclusively upon a state-trading basis. Before the war, the Soviet Union transacted only a little more than 1 per cent of foreign trade business, but its future sphere of influence will be large—conceivably embracing as much as 30 per cent of total international trade.

We Cannot Afford to Refuse It

If the weight of British influence in foreign trade is thrown toward the Russian pattern rather than toward ours, it is apparent that bloc trading, with all of is supporting devices—bilateral deals, exchange controls, import and export quotas, subsidies, currency manipulations and the like —will be the prevailing pattern for foreign transactions.

In self-protection, the United States would have no alternative but to conform to the dominant pattern. We should be forced to form our own bloc, and to enter into active economic warfare in bidding for trade concessions against the offers of our rivals. How well we would do this is problematical. To the game we would bring the largest economic potential in the world. But our handicaps would be equally impressive.

First, under a system in which political and economic motivations are inextricably fused, a democratic nation, and particularly one with a tradition of freedom in its domestic enterprise, would operate at a great disadvantage. We should inevitably be driven toward more and more government control of our entire economy.

Second, with a pattern of foreign trade in which our exports habitually are greater than our imports, our bargaining position in international trade is much weaker than our over-all economic strength would suggest. Under state-controlled trading we should still find it difficult to compete successfully without resort to loans, and under these conditions our loans would be supporting a system alien to our choice and interest.

Third, under a regimented system which made economic decisions subservient to political considerations, it is virtually certain that the volume of world trade would shrink. That was the clear experience of the nineteen-thirties. Thus, the

standard of living in the United States would suffer in common with all others, and we would be forced into a particularly drastic curtailment of certain war-expanded segments of our economy, at the very time when a large portion of the world is most in need of the products they can produce.

Weighing the Alternative Costs

In the years immediately ahead it is certain that from two-thirds to three-quarters of all international trade will be transacted either in pounds or dollars. If both circuits are linked in a determined effort to restore competitive world markets, to which buyers and sellers alike have access without discrimination, that will be the dominant system of foreign trade. If the sterling group with its satellites organizes a closed grid, our exclusive effort cannot preserve the trade pattern that we believe offers most to us and to the world.

No one can accurately measure the costs to the United States of refusing the loan and accepting the consequences. But unquestionably they would dwarf to insignificance the sum risked in the proposed credit. We would lose through the shrinkage of our trade, through the wrench of violent readjustments in our production patterns, and eventually through the curtailment of our over-all output below what it would be under an open rather than a closed system. We would lose heavily in economic liberty under a procedure that can be followed with success only by a close regimentation of production as well as trade.

Most of all, we would lose in prestige, through demonstrating that we are still unprepared to exercise a world leadership to which our giant stature as the possessor of almost half of the world's economic capacity entitles us. Once again we would be exhibiting to the world political feet of clay supporting an economic frame of heroic proportions.

It Is Far from a "Soft" Bargain

There has been some disposition in this country to regard the loan to Britain as a somewhat "soft" and generally unprecedented transaction that smacks of charity. This is the sheerest nonsense.

In the first place, the kind of economic system we want has never functioned and cannot operate now without a lender. For many decades prior to World War I Great Britain filled the creditor role. In 1913 her foreign investments totaled $19 billions, and she not only made such transactions pay, but they proved her salvation through two grim wars. Her credits helped in the industrial development of a large segment of the world, including the United States. Of all the nations in the world, only the United States can assume now the mantle which Britain no longer can support.

In the second place, the terms of our proposed loan to the United Kingdom are far from easy. Britain put a substantially greater proportion of her relatively meager resources into the war than we did, and dissipated a large share of her foreign holdings in the process while accumulating an outside debt of crushing magnitude. On a per capita basis her internal debt is greater than ours. Many Britons feel that our proposed loan is too small, and its terms too rigorous. If the amount proves to be inadequate, we shall have to consider supplemental aid at a later date. But the majority believe that the present offer gives a fighting chance to restore the system of world trade that we and they both want, and upon which the World Bank, the Monetary Fund, and the International Trade Organization under United Nations aegis are based. It is certain that without our loan all of this will go by the board.

In the third place, our proposed loan is far from being without precedent. Canada, which is linked by far closer economic ties to us than to the Empire, already has provided for a loan to Britain of $1,200,000,000. This amounts to almost a third of what we propose to lend, although Canada's population is less than 10 per cent, and her income is little more than 5 per cent of ours.

Shall the United States Lead or Follow?

The way to exercise leadership is to lead. Nothing could be more futile than to go half way toward establishing the economic order for which we stand, and then withhold the crucial measure that will make it work. Failure to approve the loan to Britain will be a clear default of leadership. Failure to approve it promptly will dissipate its effectiveness.

It has been officially stated that the British loan is a unique case that will establish no precedents for further credits to other nations. It is exceptional in its importance to our aim. But if the United States expects to make its economic program the dominant one for world trade, it must continue to exercise the creditor function without which that program cannot persist.

The most that we should ask is that future loan transactions be scrutinized as was this one to see that they offer comparable security and comparable return in support of the program for which we stand.

For the loan to Britain, it can be said that never before has one nation had an opportunity to gain so much at so little risk as has the United States in this uniquely decisive case.

President, McGraw-Hill Publishing Co., Inc.

Electrical World

APRIL 27, 1946

A Weapon Against Inflation

CAN TECHNOLOGICAL development continue to hold prices in check as it has for the past four or five decades while the wages of labor advanced many fold? There would be no hesitation in saying yes, were it not for the fact that the hurdle has been raised considerably by the addition of the expanding cost of government. Federal taxes are on a permanently higher level, and must be taken into consideration when weighing the long term possibilities of price stabilization.

To the extent that we do not lick this problem through technological advances in our methods will we have inflation. There may be great discoveries, yet to be unveiled, that will so revolutionize our processes and our manner of living as to make all of our present worries seem insignificant, but what have we got today? How can we improve the productivity of labor sufficiently to keep costs down to the level that will permit maintenance of price levels?

This is not a new challenge to electricity. In the nearly two-thirds of a century that central station service has been available, there never has been a time when it was not contributing to improved ways of doing things, and during the war largely because of that contribution this nation, with the highest power per worker of all the combatants, was able to out-produce them all.

It has always been true that application has lagged cautiously behind technological advances in the electrical field. Today, particularly is this true in the fields of heat where infrared and high frequency offer great possibilities for speeding production. No one knows how far electronics can go in process improvement, but the glimpses we have seen so far in this youngest of all electrical technological improvements show tremendous possibilities. Motorization and control have still a long way to go before they have yielded all they can to industrial efficiency, while in the oldest field of all, lighting, new sources and new knowledge can contribute to greater productivity, safety, morale and reduced spoilage.

In other words, the problem is not entirely that of technological advance. It is not enough to find new and improved ways of producing goods. They must be put to use widely and quickly, and that means selling.

In preparation for that selling more must be known of the benefits to greater productivity that will come from the latest advances in the use of electricity. In some instances power sales manuals and manufacturers' literature give a considerable amount of information, but by and large there are still insufficient data to enable the salesman to show the benefits in terms of actual process costs or production figures.

In some applications this information should not be difficult to obtain, because it can be isolated and measured. In other instances, such as lighting, it will not be easy because of the difficulty of separating the benefits contributed by several factors. Because the data are needed and can be used not only to build load, but to assist in solving our biggest national problem, research is indicated to show how much electrical improvements can contribute to increased worker productivity.

Armed with the knowledge of what electricity can do, sales can translate the benefits of electrical technological advances into productivity increases that will do more than a little to help maintain price levels.

Switched

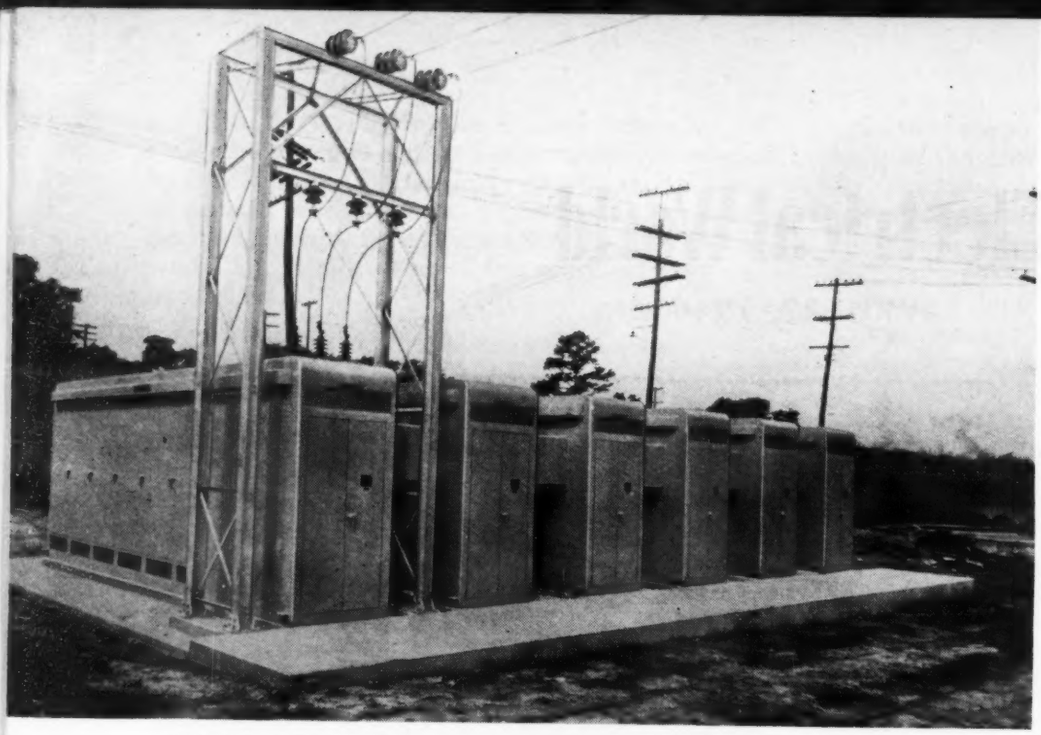
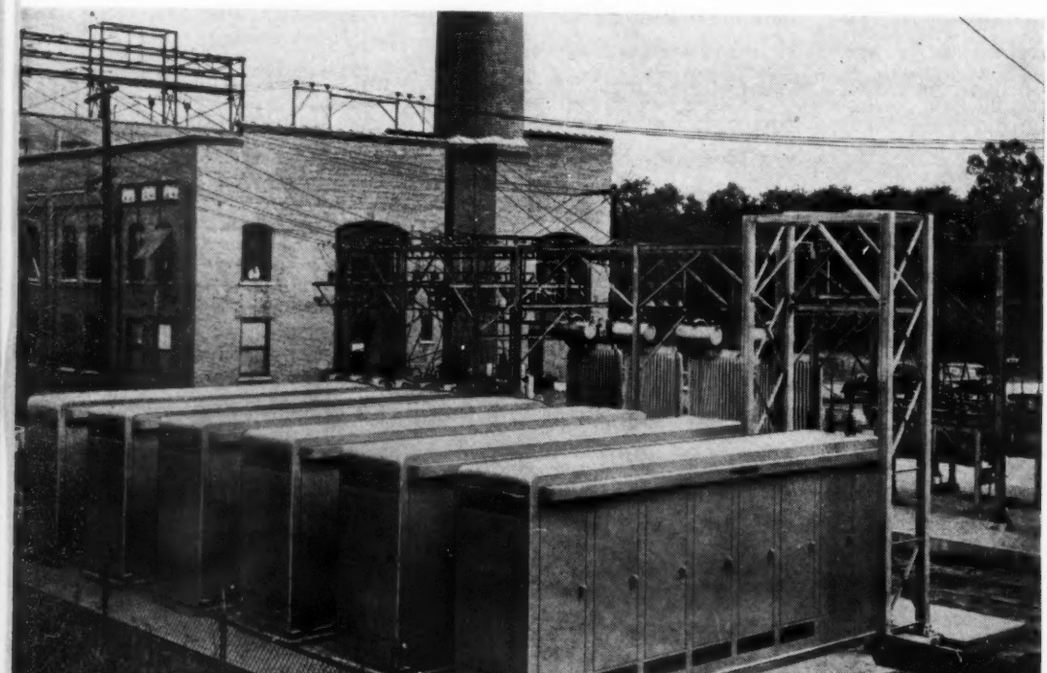


FIG. 1—General Electric Pyranol capacitor installation totals 15,120 kvar, comprising six floating-neutral units of 2,520 kvar, 13.8 kv. each. Automatic control with Magneblast air circuit breakers. Above, front view of installation; below, view with local generating station in background



Inadequacy of boost transformers met by 15,000 kva. of switched capacitors on 13.8 kv. and 5000 kva. fixed on 4 kv.—Cost, losses, likelihood of trouble, transfer elsewhere and performance as a whole most favorable—Three operations per breaker per day

AUGUSTA, GA., and surrounding territory was originally supplied with electrical energy from nearby steam and hydro plants. Some 17 years ago a 110-kv. transmission line was constructed, connecting the city and its power sources to the Georgia Power Company's Tallulah Falls hydro plant. As load in the area increased, it eventually became necessary to install a booster bank in this line, voltage being controlled by the adjacent Stevens Creek hydro plant, and 10,000 kva. in synchronous condensers at Augusta. With further load increases, the Stevens Creek plant was unable to carry the load even temporarily in event of loss of the Tallulah Falls line. Studies were made to determine the feasibility of building a 110-kv. line from Warrenton to Augusta, thus connecting Augusta to the Arkwright steam plant with a line whose total length was about the same as the Tallulah Falls-Augusta line.

Line Capacity Limited

The problem was complicated by a number of factors. Neither line by itself could carry the entire area load without a boost obtained by boosters, regulators, or condensers. Tallulah Falls was in an area of hydro generation, and Plant Arkwright in an area of steam generation. Reactive load had habitually been carried on the hydro plants, resulting in a voltage level on peak at Tallulah Falls of approximately 116 to 118 kv. and a voltage level at Plant Arkwright of 106 to 108 kv.

A calculating board study of the situation was made and it was found practical to connect the Warrenton

CAPACITORS

Retrieve Line Loading Capacity

R. O. LOOMIS, *Distribution Engineer, and* **E. J. ARCHBOLD**, *General Design Engineer*
Georgia Power Co., Atlanta

line to Augusta by leaving the booster bank (shown in that line in Fig. 2) near Plant Arkwright in place, but removing the booster bank from the Tallulah Falls-Augusta line and replacing it with sufficient reactive generation on the 13.8-kv. bus at Augusta to give the required boost. It was determined that each 1,000 kva. of reactive generation on the 13.8-kv. bus at Augusta produced 0.9 percent voltage boost with both 110-kv. lines in service and 1.4 percent boost with one line in service.

Analyses of light load conditions and peak load conditions were made to determine tap settings of the 110/13.8-kv. transformers and the required reactive generation.

30,000 Kva. Required

At a peak load, with only one line in service, and with transformers set on the lowest high voltage tap, a total of 25,000 kva. of reactive generation was required. This was 15,000 kva. more than the existing 10,000 kva. in condensers. The 5,000-kva. bucking ability of the existing condensers was then required to hold proper voltage at light load periods with both lines in service. The total range was therefore 30,000 kva.

It was found that the 4-kv. system could use 5,000 kva. in non-switchable capacitors and since these were the cheapest capacity available, considering their other benefits, it was decided to consider them for the first 5,000 kva. A new 10,000-kva. synchronous condenser could then provide the remaining capacity required. Its 5,000-kva. bucking ability could cancel out the 5,000 kva. of fixed capacitors at light load resulting in the 30,000-kva. range and the lowest tap operation described above.

Cost Comparisons Made

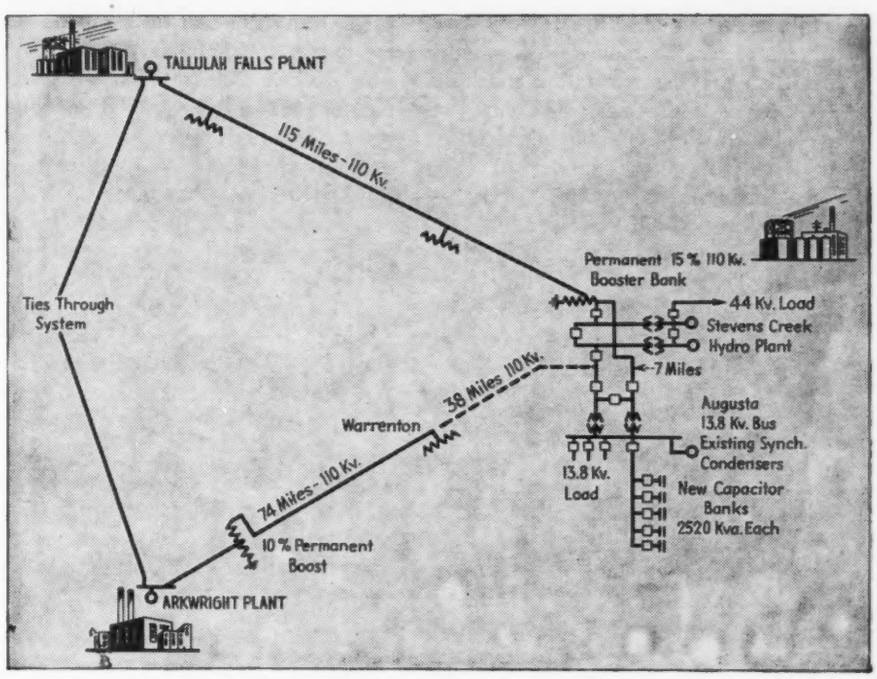
Compared to the 10,000-kva. condenser, consideration was also given to the use of 15,000 kva. of switchable capacitors. With these the maximum capacity available would be their 15,000-kva. capacity, plus 5,000 kva. on the 4-kv. system, plus the existing 10,000 kva. of synchronous capacity, or a total of 30,000 kva., and the minimum would be zero, since the 5,000 kva. of 4-kv. capacitors could be cancelled by the existing condensers. By raising the 110-kv. transformer taps to a point 5 percent above the lowest tap, the same control could be exercised over the 13.8-kv. bus voltage as described above.

Cost comparisons indicated that 15,000 kva. of switchable capacitors would cost slightly more than a 10,000-kva. synchronous condenser, although it was difficult to estimate building costs required by the synchronous condenser due to war conditions.

Advantages of Capacitors

A decision to install the static capacitors was made on the ability to get them installed in four or five months, compared to a year for the rotating machine, and because the static ca-

FIG. 2—Simplified diagram of east section of Georgia Power system indicating voltage and capability reasons for capacitor installations



pacitors have other important advantages, as follows:

1. *Increased Peak Load*

As peak load increases, off-peak kilovars increase, resulting in less use of the bucking ability of synchronous condensers; that is, the increases in load result in lower 110-kv. voltage levels. The static capacitors, by permitting operation on a higher 110-kv. tap, provide 5 percent more tap range; or, in other words, provide a 5 percent higher 110-kv. operating voltage at present. Therefore, the extra 5,000 kva. in the capacitors (compared to a synchronous condenser) provides additional 110-kv. line capacity.

2. *Less Losses*

Losses are less with static capacitors. This loss difference is somewhat magnified in this case because a synchronous condenser would have to be running continuously to provide protection, with attendant losses, whereas a portion of the static capacitors are normally deenergized. With energy at 5 mills, the difference in losses is estimated to be $4,000 per year.

3. *Continuity of Service*

In case of trouble with a synchronous condenser its entire capacity is out of service, perhaps for a matter of days or weeks, with resulting low voltage. It is unlikely that more than 2,520 kva. of static capacitors will be out of service at any time, and then for only a relatively short period.

4. *Movability*

Whenever more generating capacity is installed in the area, the static capacitors can be moved with smaller loss than moving a rotating machine. Also, since the switchable static capacitors are obtainable in identical units, any required number of units can be moved.

5. *System Stability*

Either capacitors or a synchronous condenser was satisfactory from the standpoint of system stability and contribution to short-circuit duty on existing oil circuit breakers.

Three-fourths Switchable

5,000 kva. of fixed capacitors were installed on the 4-kv. system in 135-kva. and 180-kva. banks. The 15,120 kva. of switchable capacitors were connected to the Augusta 13.8-kv. substation bus, and were installed in six units, each rated 2,520 kva., 13,800 volts, 3-phase, and complete with metal enclosed bus for connecting the six units into one bank.

The units themselves were of the large rack type enclosed in metal outdoor housings. The individual Pyranol-filled capacitor units were of the indoor type, and each rated 15 kva., 7,960 volts, single-phase, 60 cycles. There are 168 capacitors in each 2,520-kva. unit, and these capacitors are mounted in three tiers with two rows of capacitors per tier on a framework of welded steel angles. The capacitors are connected wye, and each one is provided with an indicating fuse. The framework is mounted on 15-kv. insulators and the neutral operated floating.

Each 2,520-kva. unit is connected to the enclosed 13.8-kv. bus through a 15-kv., 250,000-kva., vertical-lift type air circuit breaker, and the enclosed bus is connected to the open-type station 13.8-kv. bus through a 23-kv., 500,000-kva. oil circuit breaker. Entry to the enclosed bus is through roof bushings on one of the units, and all units are designed alike so roof bushings can be added or the bus extended on each unit. Air circuit breakers are used because they are considered to be capable of large numbers of operations with less maintenance than oil circuit breakers.

Breakers Selected on Possible Future Duty

The station 13.8-kv. bus is supplied through two 15,000/20,000-kva., 110-13.8-kv. transformer banks, and the present short-circuit duty on the 13.8-kv. bus is approximately 275,000 kva. The 15-kv., 250,000-kva. air circuit breakers were considered adequate, since they are non-automatic as far as faults are concerned, and their short time rating of 30,000 amp. has an ample margin. The selection of the air circuit breakers was also influenced by their possible future duty, since in the event a generating source was added in the Augusta area, some of the 2,520-kva. units could undoubtedly be used more advantageously on some other part of the system. Their most probable future location would be at some distribution substation, close to the load where the generation of kilovars is more effective, and where the short-circuit duty would permit the air circuit breakers to be operated automatically for faults.

Although the entire block of 15,120 kva. of capacitors was connected to the 13.8-kv. station bus through an oil circuit breaker to protect the station load in case of a failure in the capacitor equipment, this engineering may have been too conservative. All the capacitor equipment was factory built and assembled, and well insulated, and would probably not have jeopardized the load if it were connected solidly to the bus through a set of disconnecting switches.

Automatically Switched

The 15-kv. air circuit breakers in each unit are used to switch the units on and off the bus automatically. The voltage level of the 13.8-kv. bus determines the number of units required, and during normal operation there is a maximum of four units on the bus at one time. Control equipment similar to that used with regulating transformers is employed in the switching, but there is one important difference. Since all breakers are not normally required to operate daily, a scheme was worked out where the breakers operated in sequence, so that over a period of time all breakers would have an equal number of operations, and thus not only distribute breaker wear evenly, but also insure that the capacitors were energized for approximately equal periods of time.

The equipment was placed in service on May 7, 1945, and so far the operation has been according to expectations. This installation may be one of the first large static capacitor installations to be switched automatically to maintain a desired voltage level. As an indication of the number of circuit breaker operations which may be expected, 659 breaker operations were recorded during the 35-day period from November 12 to December 17, 1945, divided about evenly on the six breakers. This is an average of slightly more than three operations per breaker per day. During this period the synchronous machines were on float most of the time, so these breaker operations are substantially all that are required to maintain uniform voltage.

No communication interference problems occurred as a result of installing the 13.8-kv. switchable capacitors, although it was found necessary to move one 135-kva., 4-kv. bank installed in an area of open-wire telephone circuits.

Infrared . . . *A Warm Friend for the Farmer*

J. H. VAN AERNAM, *Sales Promotion Manager, New York Power & Light Corp., Albany, N. Y.*

Milk house a cold place in winter . . . Farmer keeps warm under infrared lamps while working there . . . Other uses for portable lamp assembly

TRIALS AND EXPERIMENTS, carried on by the New York Power & Light Corp. in the past two winters, indicate that infrared lamps are a practicable means for keeping the operator warm as he cleans dairy equipment in a cold milk house. State sanitation authorities frowned on usual methods of heating because of possible contamination of the milk.

In searching for a solution to this problem, many possibilities presented themselves, were tested, and discarded. Finally, the use of infrared lamps was explored. A trial installation was made, using six R-40, 250-watt lamps. They were mounted on three walls of a 6-ft. square milk house, spaced about 18 in. apart, and focused on the area in which the operator worked. This method of mounting did not give enough heat density to make the operator feel comfortable, so another mounting was tried. The six lamps were mounted on the ceiling at a height of 6½ ft. They were in two rows 3 ft. apart, and were spaced 18 in. apart. This method was satisfactory until the temperature dropped to zero, when the operator felt uncomfortable from the cold.

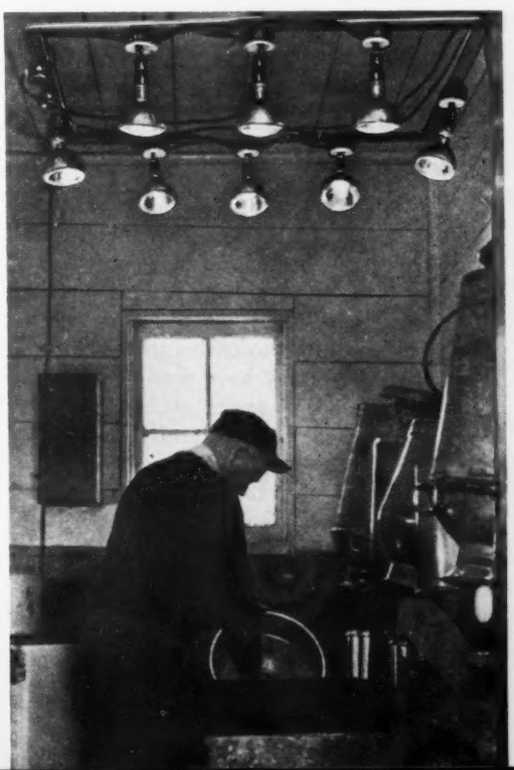
Further experimenting with the addition of two more lamps provided enough of an infrared "blanket" to overcome the lower temperatures. However, this amount of infrared proved to be too much on milder days. So a wooden rack 3 by 4 ft. was made, with one light in the middle of each of the 3-ft. sides and three lights spaced 18 in. apart on the 4-ft. sides. These lights were so wired that one switch would turn on each light on the 3-ft. sides and the middle lights on the 4-ft. sides. Another switch controlled the remaining lights on the 4-ft. sides. In this manner, it was possible to control the amount of infrared light applied.

As a result of these experiments, ceiling mounting seems desirable to protect the lamps from breakage, since if water hits the present type of infrared bulb while lighted, the lamp usually shatters. The hard glass bulb which, it is claimed, will not break when in contact with water, may permit construction of a rack to throw light on the operator from a wall location. The ceiling rack may be suspended by an ordinary hook and eye arrangement, or hooks may be used in the ceiling to suspend the unit on wire or heavy cord. The latter seems desirable in order to have the lights at the 6½-ft. level which appeared to be most practical.

It is estimated that the unit shown on this page will cost about $20 to make, including the lights. One electrician gave an estimate of $30 to make up a similar one. To justify the cost of such an installation, it seemed advisable to find additional applications. This rack was designed to be portable so that it could be used in the garage, workshop or home, when and where heat is needed. The lights were mounted on adjustable sockets so that the rays might be concentrated or diffused, as the job requires.

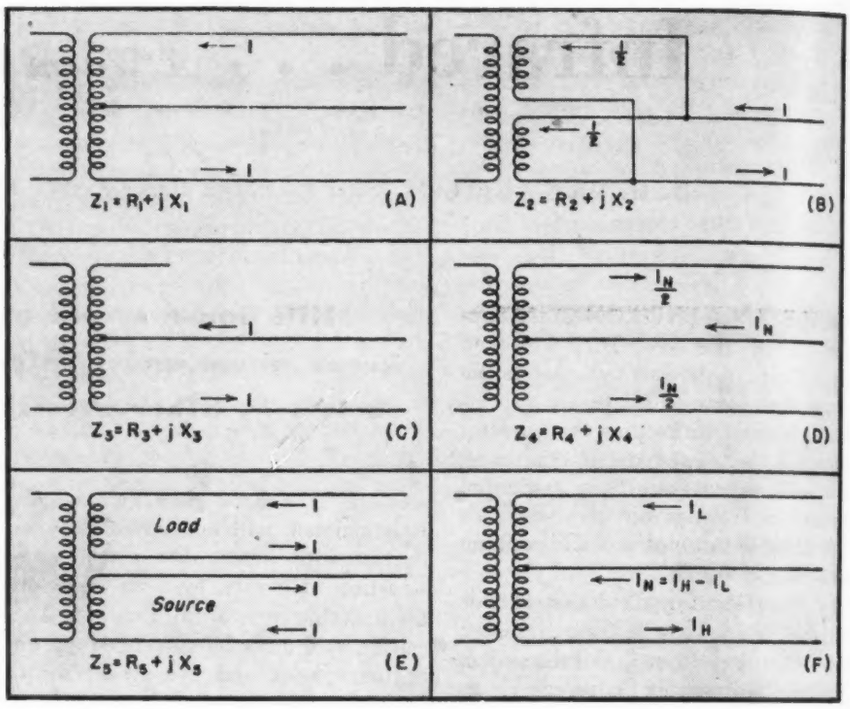
One job in which it proved to be valuable was in thinning the oil of a tractor when the oil was so thick that compression could not be sealed. The lights were focused on the pan, thinning the oil so that it could flow easily. In another case, four of the lamps were focused on a magneto distributor of a tractor that was so covered with frost that the ignition was shorted. Twenty-two minutes after the lamps were turned on, the tractor was started. One farmer was enthusiastic because of the warmth and light while he worked in the milk house, and in addition the infrared light melted the ice on the floor and opened the drain.

WOODEN RACK holding infrared lamps is suspended from ceiling. Farmer washing milk equipment and utensils is comfortably warm. Rack can be carried conveniently to other buildings for use wherever needed



FIGS. A-F. Typical balanced and unbalanced load on 240/120-volt secondaries

A. Balanced 240-volt load
B. Windings in parallel
C. Load on one 120-volt winding
D. Autotransformer
E. 120/120-volt operation
F. Normal operation, unbalanced load



JOHN W. ANDERSON, 3D
Assistant Superintendent
Philadelphia Division
Philadelphia Electric Co.

Formulas for VOLTAGE DROPS on Unbalanced Secondary Circuits*

Plenty of guesswork and just plain trustfulness accompanies most of the dependence on voltage performance of 3-wire secondaries with unbalanced loading. As the author says, new loadings and starting currents are coming, sure as fate, and they are likely to be less well balanced throughout the day than present loads.
These computations by the author are the fruits of much "midnight oil" and are published in the hope they will lead to a better understanding of a neglected and somewhat obscure problem.—Editors

WITH THE ADVENT of post-war appliances, the secondary distribution system will be called upon to supply new types of loads as well as larger models of familiar equipment. Many of these devices will operate at nominally 115 or 120 volts and the problem of maintaining adequate secondary voltages both for normal operating conditions and for motor starting can be expected to assume major proportions. In some cases the devices will impose severe duties on distribution systems, but because of poor load factor, will produce but little revenue toward justifying investment for voltage relief.

Some of the devices that may be used where the ordinary simple radial transformer-secondary combination is found to be inadequate and where cost or physical difficulties preclude the installation of additional transformers with possible primary extensions or increasing secondary copper size, might be:

1. Looped secondaries
2. Autotransformers
3. Banked transformers
4. Combinations of the above

All of the above involve multiple current paths between source and load. The predetermination of voltage drops increases in complexity as the number of current paths is increased. As a possible aid in shortening the work of others who may have need to compute voltage drops under such conditions as those outlined, several general formulas have been developed which are presented herewith. Although some are bulky, they involve only algebra of complex quantities which may be handled readily by any young engineer.

The formulas may be used rigorously as given or, for simplification which results in some error, an approximate value of load current (I_M) may be assumed. This avoids the calculation Z_{TS}. The portions of I_M appearing in the various wires of the network may thus be computed from the formulas and from this current division, the voltage drop to the load readily determined. For example, the locked rotor current of a motor may be 35 amperes at normal voltage. The actual current taken when it is connected to a transformer-secondary network will be determined by the voltage applied to the transformer and the impedance of the

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network (Z_{TS}). Using the formulas in conjunction with the locked rotor impedance of the motor gives a rigorous determination of the actual I_M and the voltage at the motor service. However, for approximate work, I_M may be taken at 35 amperes, thus avoiding the need to determine Z_{TS}. From this point on, the procedure is the same for both rigorous and approximate work; that is, the portions of I_M in the various wires of the circuit may be determined from the formulas for I_a, I_b, etc., and the total voltage drop to the load computed from this current division.

The error between the rigorous and approximate methods is variable, and increases as the length of secondary increases.

Where two or more loads are involved, the appropriate formulas for current division can be used for each individual load and the summation of currents in various parts of the circuit obtained by the superposition method.

Transformer Impedances and Voltage Drops

Some explanation is necessary in regard to the determination of impedance and voltage drops in distribution transformers as used in the formulas.

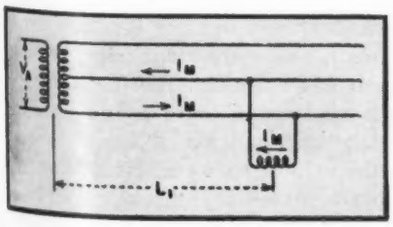
A transformer has a different impedance for each job it is given to do. Five different impedances are illustrated in Figures A, B, C, D, E. The percentage resistance, reactance, and impedance customarily supplied by the manufacturer apply only to Figures A and B; that is, to the rather special cases where the currents in the two secondary windings are exactly balanced. Even in these two cases, the *ohmic* values are not the same. There are, however, certain fairly definite relationships among these various impedances; for example, when only one 120-volt winding is loaded (Figure C),

FIG. 1—Radial secondary

$$Z_{TS} = Z_s + (z + z_n)\, L_1$$

$$I_M = \frac{V_A}{Z_{TS} + Z_M}$$

$$V_{TS} = I_M Z_{TS}$$



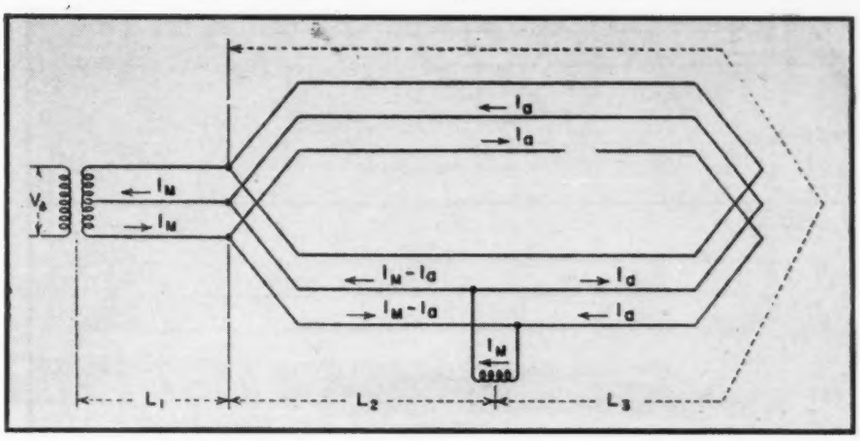


FIG. 2—Looped secondary

$$Z_{TS} = Z_s + \frac{(z + z_n)\,(L_1L_2 + L_2L_3 + L_1L_3)}{L_2 + L_3}$$

$$I_M = \frac{V_A}{Z_{TS} + Z_M}$$

$$I_a = \left[\frac{(z + z_n)\, L_2}{(z + z_n)\,(L_2 + L_3)}\right] I_M$$

$$V_{TS} = I_M Z_{TS}$$

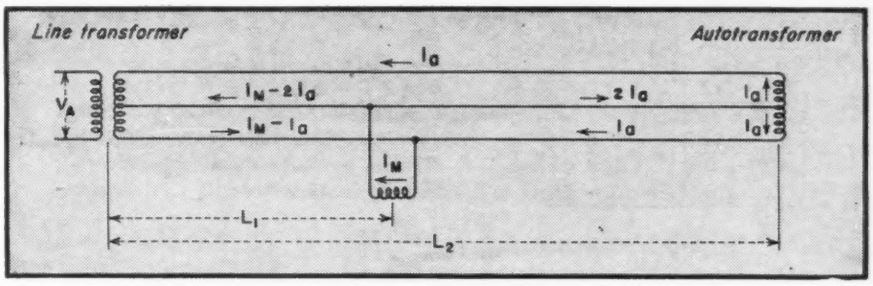


FIG. 3—Radial secondary with autotransformer

$$Z_{TS} = \frac{BC - 4A^2}{4B}$$

$$I_M = \frac{V_A}{Z_{TS} + Z_M}$$

$$I_a = \left[\frac{A}{B}\right] I_M$$

$$V_{TS} = I_M Z_{TS} = \frac{CI_M - 4AI_a}{4}$$

$$A = 2Z_4 + (z + 2z_n)\, L_1$$

$$B = 4Z_4 + Z_o + 2\,(z + 2z_n)\, L_2$$

$$C = Z_1 + 4Z_4 + 4\,(z + z_n)\, L_1$$

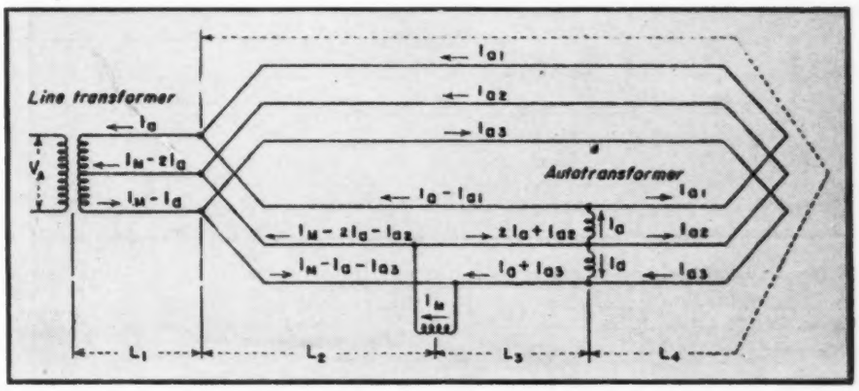


FIG. 4—Looped secondary with autotransformer

$$Z_{TS} = \frac{BC - 4A^2}{4B}$$

$$I_M = \frac{V_A}{Z_{TS} + Z_M} \qquad I_a = \left[\frac{A}{B}\right] I_M$$

$$V_{TS} = I_M Z_{TS} = \frac{CI_M - 4AI_a}{4}$$

$$I_{a1} = \left[\frac{z\,(L_2 + L_3)}{z\,(L_2 + L_3 + L_4)}\right] I_a$$

$$I_{a2} = \frac{I_M z_n L_2 - 2I_a z_n\,(L_2 + L_3)}{z_n\,(L_2 + L_3 + L_4)}$$

$$I_{a3} = \frac{I_M z L_2 - I_a z\,(L_2 + L_3)}{z\,(L_2 + L_3 + L_4)}$$

$$A = 2Z_4 + (z + 2z_n)\,(L_1 + L_2) - \frac{(z + 2z_n)\, L_2\,(L_2 + L_3)}{L_2 + L_3 + L_4}$$

$$B = 4Z_4 + Z_o + 2\,(z + 2z_n)\,(L_1 + L_2 + L_3) - \frac{2\,(z + 2z_n)\,(L_2 + L_3)^2}{L_2 + L_3 + L_4}$$

$$C = Z_1 + 4Z_4 + 4\,(z + z_n)\,(L_1 + L_2) - \frac{4\,(z + z_n)\, L_2^2}{L_2 + L_3 + L_4}$$

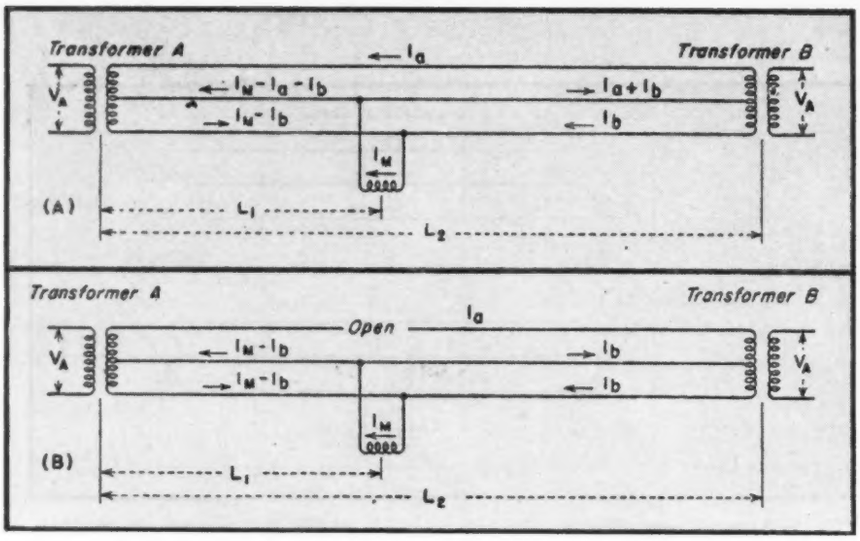


FIG. 5—Two banked transformers . . . (A) rigorous . . . (B) approximate

(A) Above

$$Z_{TS} = \frac{E\,[(A-B)\,(C-D)] - (E+F)\,(BD-AE)}{4A\,(C-D)}$$

$$I_M = \frac{V_A}{Z_{TS}+Z_M}$$

$$I_a = \left[\frac{BD-AE}{A(C-D)}\right] I_M$$

$$I_b = \left[\frac{BC-AE}{A(C-D)}\right] I_M = \left[\frac{B}{A}\right] I_M + I_a$$

$$V_{TS} = I_M Z_{TS} = \frac{E\,(I_M - I_b) - FI_a}{4}$$

$$A = Z_{1A} + Z_{1B} + 2z\,L_2$$
$$B = Z_{1A} + 2z\,L_1$$
$$C = Z_{1A} - 4Z_{4A} + Z_{1B} - 4Z_{4B} - 4z_n L_2$$
$$D = Z_{1A} + 4Z_{4A} + Z_{1B} + 4Z_{4B} + 4(z+z_n)L_2$$
$$E = Z_{1A} + 4Z_{4A} + 4(z+z_n)L_1$$
$$F = Z_{1A} - 4Z_{4A} - 4\,z_n\,L_1$$

(B) Above

$$Z_{TS} = \frac{A}{B}\,(B-A) \qquad I_a = O \qquad I_b = \left[\frac{A}{B}\right] I_M$$

$$I_M = \frac{V_A}{Z_{TS}+Z_M}$$

$$V_{TS} = I_M Z_{TS} = A\,(I_M - I_b)$$

$$A = Z_{3A} + (z+z_n)\,L_1$$
$$B = Z_{3A} + Z_{3B} + (z+z_n)\,L_2$$

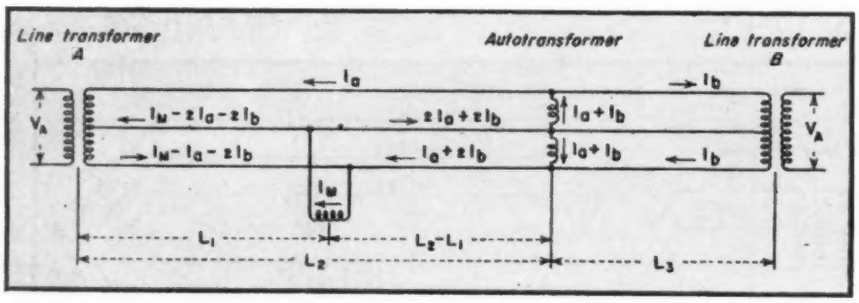


FIG. 6—Two banked transformers with one autotransformer

$$Z_{TS} = \frac{DE\,(B-A) - 2C\,(2BC-AD)}{4\,BD}$$

$$I_M = \frac{V_A}{Z_{TS}+Z_M}$$

$$I_a = \left[\frac{2\,BC-AD}{2\,BD}\right] I_M = \left[\frac{C}{D}\right] I_M - I_b$$

$$I_b = \left[\frac{A}{2\,B}\right] I_M$$

$$V_{TS} = I_M Z_{TS} = \frac{E\,(I_M - 2I_b) - 4CI_a}{4}$$

$$A = Z_{1A} + 2zL_1$$
$$B = Z_{1A} + Z_{1B} + 2z\,(L_2 + L_3)$$
$$C = 2Z_{4A} + (z+2z_n)\,L_1$$
$$D = 4Z_{4A} + Z_0 + 2\,(z+2z_n)\,L_3$$
$$E = Z_{1A} + 4Z_{4A} + 4\,(z+z_n)\,L_1$$

the percent *IR* and the percent *IX* (on a kva. base equal to the capacity of that winding or one-half of nameplate rating) are approximately 0.75 and 0.55 of full winding percent *IR* and percent *IX* respectively; similarly, with 1/1 operation with one 120-volt winding the source and the other loaded (Figure E), the percent *IR* and the percent *IX* (on a kva. base equal to one-half of nameplate rating) are approximately 1.00 and 0.20 of full winding percent *IR* and percent *IX* respectively.

Although only three values of impedance appear in the general formulas to follow, all five values are included here for completeness and for such application as they may have to other problems, as for example, the determination of the three fictitious star-connected impedances forming the usual equivalent circuit of a three-winding transformer.

For use in the formulas, transformer impedances must be expressed in ohms referred to secondary voltage. Ohmic values may be computed by formula:

$$R = \frac{10\ (\text{kv.})^2}{\text{kva.}} \times \%IR$$

where R = resistance of transformer in ohms
$\%IR$ = percent resistance from manufacturer's data
kv. = voltage rating of transformer in kilovolts
kva. = kva. rating of transformer

Similarly, the ohmic values of reactance and impedance can be computed from the formula by substituting $\%IX$ and $\%IZ$.

Having found basic ohmic values for Figure A or Figure B from manufacturer's percentage values, the ohmic values of resistance and reactance for the other diagrams may be computed as follows:

	Resistance	Reactance	Impedance
Figure A....	R_1	X_1	Z_1
Figure B...	$R_2 = .250\ R_1$	$X_2 = .250\ X_1$	Z_2
Figure C...	$R_3 = .375\ R_1$	$X_3 = .275\ X_1$	
Figure D...	$R_4 = .125\ R_1$	$X_4 = .025\ X_1$	Z_4
Figure E...	$R_5 = .500\ R_1$	$X_5 = .100\ X_1$	Z_5

It will be noted that

$$Z_2 = \frac{Z_1}{4}$$

$$Z_3 = Z_2 + Z_4 = \frac{Z_1}{4} + Z_4$$

$$Z_4 = Z_3 - Z_2 = Z_3 - \frac{Z_1}{4}$$

$$Z_5 = 4Z_4 = 4Z_3 - Z_1 = 4\,(Z_3 - Z_2)$$

These relationships are average values developed from data recently obtained from several ranking transformer manufacturers and, although individual transformers will deviate therefrom in some degree, apply with reasonable accuracy to the entire range of kva. ratings.

The general case, however, is a transformer connected as in Figure A but with unbalanced secondary loading as in Figure F. In this case, the voltage drop in each secondary winding may be computed by dividing the current in each winding into two components, one component being a balanced 240-volt load flowing through both windings in series as in Figure A and the other component being one-half of the neutral wire current flowing in opposite directions through the two windings as in Figure D. In the lightly

loaded winding, the two components are in opposite directions and subtract, whereas in the heavily loaded winding, they are in the same direction and add. The balanced component is the average current in the two windings, that is:

$$\frac{I_H + I_L}{2}$$

The impedance of the transformer viewed by this component is Z_1, whereas the impedance encountered by I_N is Z_4. Thus the voltage drop in either winding can be computed:*

$$V_L = \left[\frac{I_H + I_L}{2}\right]\frac{Z_1}{2} - I_N Z_4$$

$$V_H = \left[\frac{I_H + I_L}{2}\right]\frac{Z_1}{2} + I_N Z_4$$

These basic formulas for transformer voltage drop have been used in the development of the accompanying general equations for determining voltage drop in combined transformer-secondary networks. These formulas, presented in Figs. 1-7 in chart form, will be self-explanatory when considered with the foregoing discussion of transformer impedances and the table on nomenclature. Seven numerical examples illustrating the use of the general equations are also given.

*The author is indebted to W. T. Brown, Engineering Department, Philadelphia Electric Co., for this method of computing transformer voltage drop.

NOMENCLATURE

Note: All quantities are vectors

V_A volts—voltage applied at primary terminals of distribution transformer in terms of equivalent secondary voltage
V_L volts—voltage drop in lightly loaded side of distribution transformer
V_H volts—voltage drop in heavily loaded side of distribution transformer
V_{TS} volts—voltage drop in transformer-secondary combination (does not include drop in service wires)
I amperes—transformer load current
I_L amperes—current in lightly loaded side of transformer
I_H amperes—current in heavily loaded side of transformer
I_N amperes—current in secondary neutral wire at transformer
I_M amperes—current taken by 2-wire load M
I_a, I_{a1}, I_{a2}, I_{a3}, I_b amperes—portions of I_M appearing in various parts of the transformer-secondary combination
R_1, R_2, R_3, R_4, R_5 ohms—various resistances of a distribution transformer referred to the secondary side
X_1, X_2, X_3, X_4, X_5 ohms—various reactances of a distribution transformer referred to the secondary side
Z_1, Z_2, Z_3, Z_4, Z_5 ohms—various impedances of a distribution transformer referred to the secondary side
Z_a ohms—impedance of autotransformer
Z_{TS} ohms—impedance of transformer-secondary combination viewed from load M
Z_M ohms—impedance of 2-wire load M
z ohms—impedance of secondary phase wire per unit length
z_n ohms—impedance of secondary neutral wire per unit length
L_1, L_2, L_3, L_4—linear distances along secondary, as indicated
A, B, C, D, E, F, G ohms—simplifying impedance coefficients; values specifically noted where used

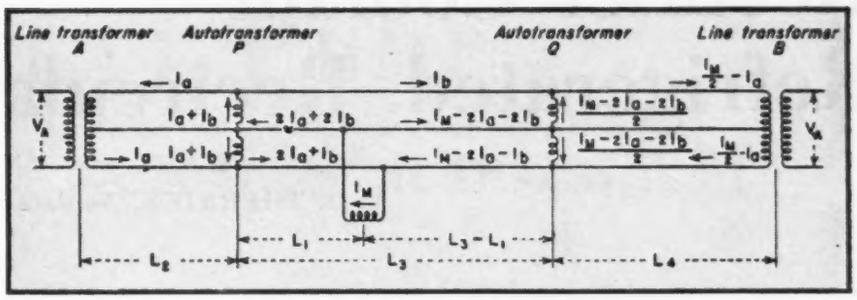


FIG. 7—Two banked transformers with two autotransformers

$$Z_{TS} = \frac{AEF + G(BC - AD)}{4BE}$$

$$I_M = \frac{V_A}{Z_{TS} + Z_M}$$

$$I_a = \left[\frac{A}{2B}\right] I_M$$

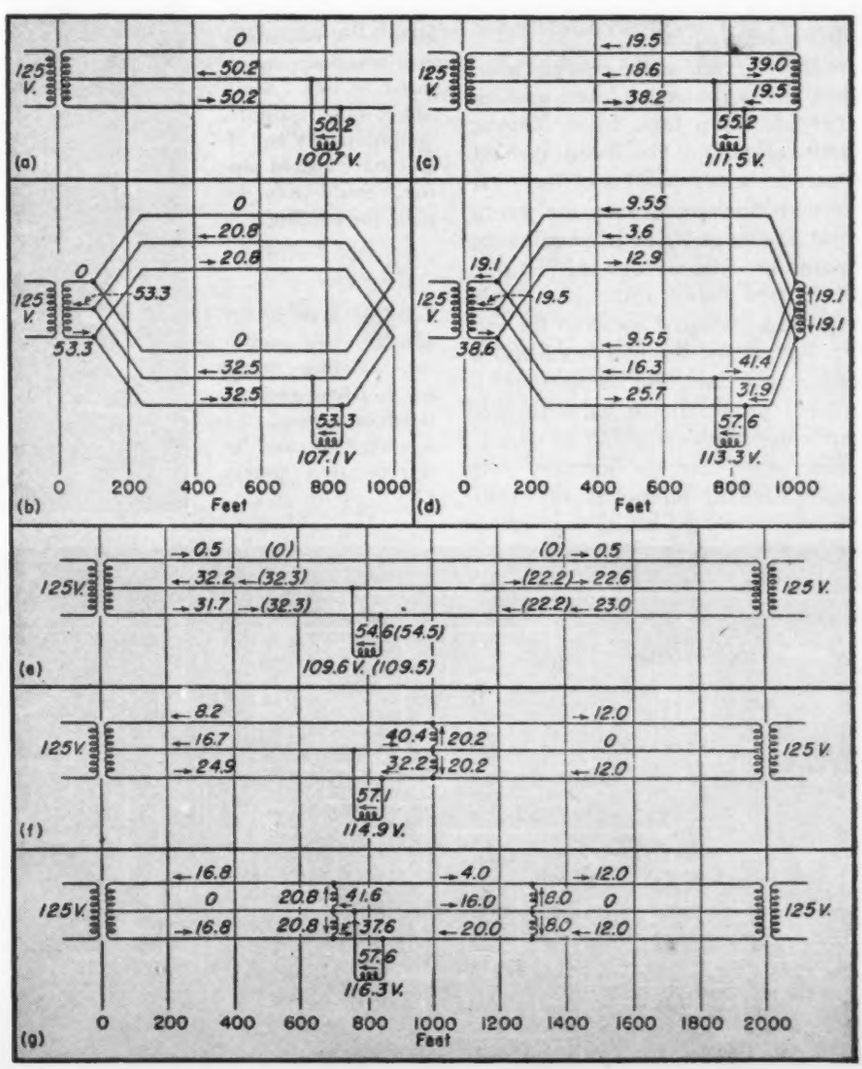
$$I_b = \left[\frac{BC - AD}{2BE}\right] I_M = \left[\frac{C}{2E}\right] I_M - \left[\frac{D}{E}\right] I_a$$

$$V_{TS} = I_M Z_{TS} = \frac{F I_a + G I_b}{2}$$

$$A = Z_{1B} + 2z\,(L_2 + L_4 - L_1)$$
$$B = Z_{1A} + Z_{1B} + 2z\,(L_2 + L_3 + L_4)$$
$$C = Z_{1B} + Z_{OQ} + 2z\,L_4 + 4(z + z_n)(L_3 - L_1)$$
$$D = Z_{1A} + Z_{1B} + Z_{OP} + Z_{OQ} + 2z\,(L_2 + L_4) + 4\,(z + z_n)\,L_3$$
$$E = Z_{OP} + Z_{OQ} + 2\,(z + 2z_n)\,L_3$$
$$F = Z_{1A} + Z_{OP} + 2z\,L_3 + 4\,(z + z_n)\,L_1$$
$$G = Z_{OP} + 2\,(z + 2z_n)\,L_1$$

FIG. 8—Numerical examples typify application of the formulas derived. Each is based on a motor having a locked rotor current of 57 amperes at 115 volts, 72 percent power factor, located on a No. 4 secondary 800 ft. from a 10-kva. transformer. The autotransformer where used is rated at 2 kva.

(a) See Fig. 1 (c) See Fig. 3 (f) See Fig. 6
(b) See Fig. 2 (d) See Fig. 4 (g) See Fig. 7
(e) See Figs. 5A & 5B (Numbers in parentheses refer to Fig. 5B)



Rectifier Coolant Refrigerated, Recirculated

A. D. THERRIEN, *Northern Indiana Public Service Co., Hammond*

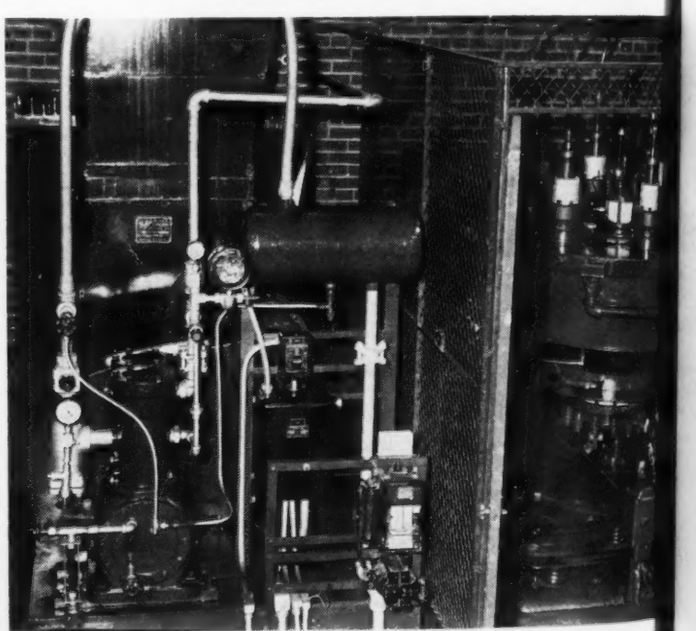
BECAUSE water available in the neighborhood of Furnessville substation of this company is contaminated with algae that clogs piping in a short time, it has been necessary to recirculate cooling water for the station's two mercury arc rectifiers continuously and resort to mechanical refrigeration to cool it. This somewhat novel arrangement has been in use for the past several years during which time operation has been satisfactory.

Furnessville is an unattended supervisory-controlled substation where 33-kv., 3-phase a.c. power is converted to 1,500 volts d.c. for an interurban electric railroad. The station's two 750-kw., 1,500-volt mercury arc rectifiers operate in parallel from the same supply transformer and are provided with mid-tap reactors to force the units to divide load equally.

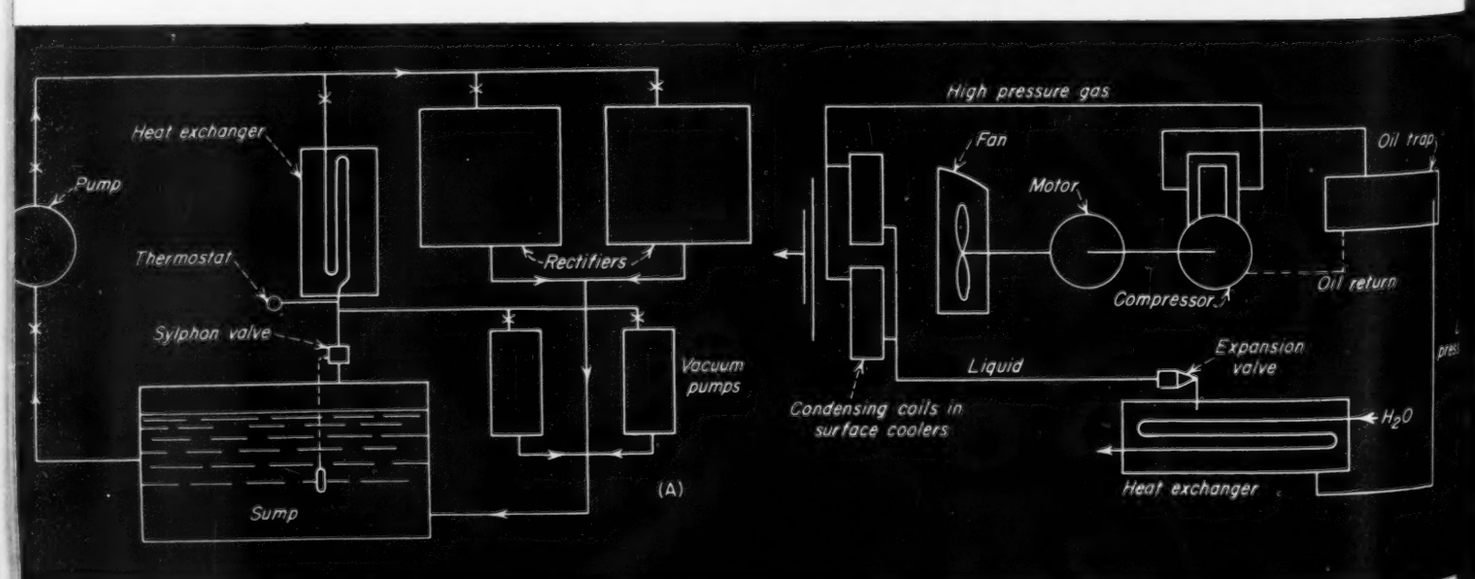
As the diagram of the cooling water system shows, water is picked up from a 300-gal. sump tank by a 30-gpm. centrifugal pump, circulated through the parallel water packets of the rectifiers and discharged into the sump. A heat exchanger, which contains the evaporating coils of the refrigerator, is connected between the pump discharge and the sump ahead of the rectifier. Water flow through this heat exchanger and into the sump tank is regulated by a sylphon valve to hold sump water temperature at 40 deg. C. Cooling water for the mercury condensate vacuum pumps is taken directly from the heat exchanger discharge ahead of the sylphon valve, to insure cold water for the vacuum pumps at all times. An automatic temperature control thermostat in the discharge side of the heat exchanger starts and stops the compressor when water temperature departs from a predetermined range.

The refrigeration cycle is conventional in most respects. Compressed refrigerant vapor is condensed in two surface air coolers in the discharge duct of a fan driven by the same 7½-hp. induction motor that drives the refrigerator compressor. Refrigerant, after passing through the expansion valve, enters the evaporator coils in the heat exchanger where it is converted to vapor by heat extracted from the circulating water. This vapor is returned to the compressor via an oil return trap for compression and recirculation. Rating of the refrigeration equipment is two tons.

Both the circulating water system and the refrigeration system are equipped with automatic controls and can operate for long intervals without attention.



Recirculated cooling water for two 750-kw. mercury arc rectifiers—one is shown behind barrier at right — is cooled by refrigeration equipment at left. Available water supply, contaminated by algae that clogged piping, could not be used for cooling



Cooling system for mercury arc rectifiers. Cooling water for rectifiers recirculated in system (A) is cooled in turn by refrigeration system (B)

HEAT PUMP
REPORT AND PROGRAM

PHILIP SPORN, *Executive Vice-President, American Gas & Electric Service Corp., New York, N. Y.*

Proposal for 1,000 units to be ordered by interested utilities as a start in promotion and sale—Tentative specification now being circulated among manufacturers and utilities—More immediate potentialities in water heating

THIS is a progress report on the heat pump and a proposal for its accelerated development as a practical house-heating and air-conditioning device. The report is not a very rosy one. But it is not all black, either. If we can enlist the cooperation of a substantial group of the industry we can look forward to a material improvement in the color of the picture. To tell how this can be accomplished is my present purpose.

During the past year interest in the heat pump has picked up considerably. A number of utilities have begun at least to discuss the possibilities of the heat pump as a year-round air-conditioning system. Several company groups have been formed to investigate the potentialities of the heat pump in their own particular geographical regions. The Pacific Coast Electrical Association, Inc., has formed such a group under the name of the "Air Heating Research Committee." The Commonwealth Edison Co. of Chicago has set up a research group under the auspices of the Utilities Research Committee. The Southeastern Electric Exchange has authorized the Southern Research Institute of Birmingham, Ala., to make some preliminary investigations. Some of the investigations of these groups have been completed while others are still in progress. The American Gas & Electric operating companies, acting through the A.G. & E. Service Corp., are continuing their research and development work. Several changes have been made in two of their heat pump designs, using air as the heat source, to improve operation and performance. Also, the Ohio Power Co. is now installing in the control building of the new Tidd power plant, Brilliant, Ohio, a 15-hp. heat pump using air as the heat source, in combination with an offpeak heating and cooling storage tank.

MR. SPORN is well known among utility people for his advocacy of development of the heat pump as a means for widened application of electric service. He has studied and analyzed its potentialities and has made several installations from which much data and experiential knowledge have been obtained. No one is better qualified to make the proposal contained in this article, which is the complete text of a paper prepared for the annual conference of the Southeastern Electric Exchange at Edgewater Park, Miss., April 24-26.

The various air conditioning and refrigeration equipment manufacturers have been showing an increasing interest in the many investigations that are being conducted throughout the United States. Two companies have designed and placed on the market self-contained heat pump units. The Muncie Gear Works, Muncie, Ind., have brought out a 3- and a 5-hp. unit using water as the heat source, and Drayer and Hansen Co., Los Angeles, Calif., have available 3-, 5-, 7½- and 10-hp. units using either air or water as the heat source.

The question now is: Where does this leave us, and what is the next logical step? Specifically:

(1) Have the investigations and trial installations shown sufficient promise to warrant a promotional program conducted on a much broader scale?

(2) Is there equipment available that the utilities can undertake to promote and sell right now?

(3) If not, is there under development equipment that would warrant such action in the reasonably early future?

(4) If "No" is the answer to questions (2) and (3), what can the utilities do about it?

I believe correct answers to all of these questions are most important if a proper policy is to be decided upon. Here are my answers in the order of the questions:

(1) Decidedly, I believe that results obtained in trial installation war-

rant a promotional program on a much broader base and of much greater scope by the utilities. And, I may add, by the manufacturers also. The manufacturers haven't been too farsighted in this matter; we need their help.

(2) Generally, "*No.*" In my judgment, there is not equipment presently available that the utilities can or should attempt to promote and sell right now.

(3) Perhaps, but we aren't aware of any such developments that are moving along fast enough. And we can't wait!

(4) I believe the utilities can do a great deal about it. The Lord still looks with favor on those who help themselves. Here's our suggestion, and we have taken the first step to carry it out:

We have sent to a group of eleven manufacturers a tentative set of specifications, covering the design of a self-contained heat pump air-conditioning unit, and looking to the production of 1,000 such units for a group of electric utility companies to be brought together for that purpose. We, in American Gas, have worked hard on this specification, but we know it isn't perfect. However, we are asking the manufacturers for comments and we shall revise the tentative specification in the light of them. We have also sent the specification to a group of utilities for their comments.

The primary reason for suggesting ordering such a large quantity of units, at the start, is to enable the manufacturers to devote a substantial amount of time and effort to research, development, and design of the unit in order properly to correlate the various requirements and produce a device having the following six basic qualities:

(a) High reliability
(b) Economical performance
(c) Reasonable first cost
(d) Low operating cost. The unit must be highly efficient and have an inherently low maintenance cost
(e) Compactness
(f) Neat appearance

I have said that we sent the specification to a group of electric utilities. They number about 50. We sent the specification to every utility we knew to be interested in the idea or who we though should be interested. If any utility didn't receive a set and is interested—I don't see how any can fail to be—if that utility will write us, I shall be glad to send a set.

We hope that each utility receiving the specification will study it, discussing all phases with interested individuals in their own organization and will suggest any changes and additions that seem advisable or that may be needed to meet local conditions. A qualified man should then be appointed to meet with representatives from the other utilities and select a group to act as an advisory board to prepare a final set of specifications which will attempt to incorporate all the sound suggestions received.

Final Specifications for the Manufacturer

It is our thought that the final specifications will be so drawn as not to favor or discourage any particular heat pump operating cycle, or to limit a manufacturer to the use of any given equipment design or arrangement. On the contrary, the aim will be to allow the specification to act as a stimulant to the manufacturer to design and develop an original, outstanding, and efficient self-contained heat pump unit. But very definitely the specification should cover all desirable, and avoid all objectionable, features based on the experiences gained from studies, trial installations, and developments made by the various individual companies. Thus, by pooling all available knowledge in this manner the first units manufactured in quantity should show considerable improvement and advancement over those which have been assembled to date.

Each electric utility, after reviewing the final set of specifications, will state the number of units which it will purchase. When the total quantity desired by all the utilities is determined, that number will be made the subject of the final specification for the furnishing of the units, and submitted to the competing group of manufacturers. When bids are received, they will be analyzed, discussed by the advisory board and a determination made as to who is to be awarded a contract.

Does this not sound like the next logical step to make the heat pump a reality as a year-round air conditioner for homes? Will a sufficient number of utilities join us and support it?

The above outlined program will necessarily cover a considerable period of time: perhaps a couple of years, perhaps even more time than that. However, there is a special application of the heat pump, which has tremendous possibilities for the immediate future, but which to date has been given very little attention and which may be brought to much earlier fruition. This is the domestic hot water heat pump. Little or no development would be required by the manufacturers to produce such a heat pump in sizes of 80 to 120 gal., using a $\frac{1}{4}$- to $\frac{3}{4}$-hp. motor. It has been found from an actual installation using the surrounding air as a heat source, that a $\frac{1}{4}$-hp., 50-gal. unit storing water at 130 deg. F. will have a coefficient of performance (COP) of 3. There is no inherent reason why the COP of a domestic hot water heat pump which would be an air to water design, using the surrounding ambient as the heat source, cannot be raised to 4 or even $4\frac{1}{2}$. If produced in quantity, such a unit should be reasonable in cost and should not have any more maintenance than experienced with the present day refrigerators.

A similar course to that just suggested for the year-round heat pump is suggested for the domestic hot water unit, except we should think in terms of 10,000 units as a starter. A specification for the manufacture of such a hot water heat pump unit is now being worked upon. This, too, will be made available to the interested utilities and to the manufacturers, with the thought that the same procedure as outlined for the year-round air-conditioning unit will be followed here.

In view of the many attractive features of such a unit and because of the possible $\frac{2}{3}$ to $\frac{3}{4}$ reduction in power consumption over an equivalent size electrical resistance water heater, this program, if followed through, should make possible universal electrical hot water service in every home having electrical service. If we get action immediately, the manufacturer or manufacturers ought to be able to get into production within 18 months or two years at the outside.

Here, too, I ask you: If this sounds like a logical step, will you join us and support it?

I believe that both of these heat pump applications, if properly developed, will prove to be practical devices; they will have a ready market and offer a most attractive load to the electric utilities. The utilities, however, need to give them a boost to bring about proper and early development. What are we waiting for?

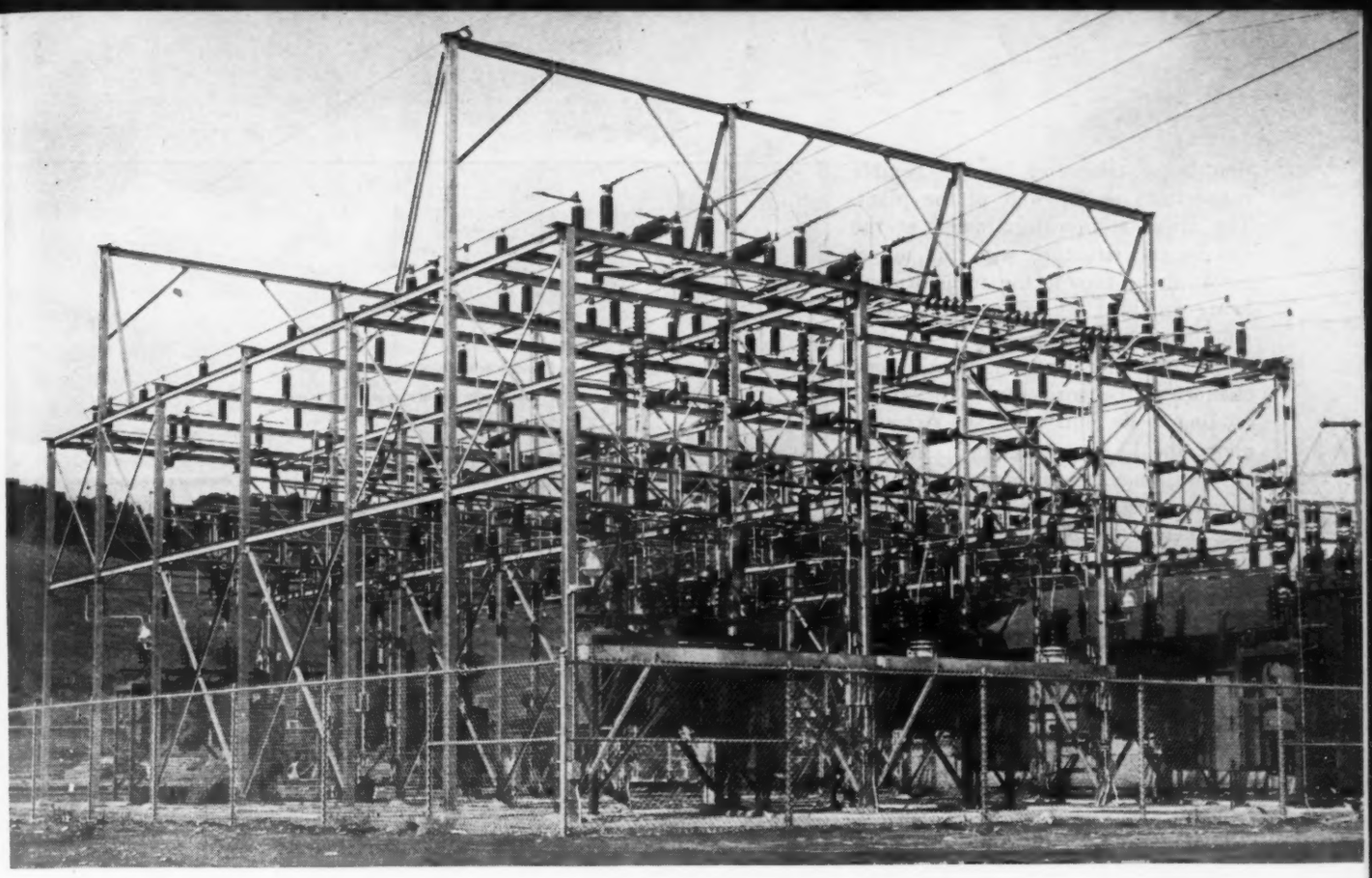


FIG. 1—The 46-kv. switching structure has buses and taps of aluminum pipe or ACSR

All Power Handled on ALUMINUM BUSES

D. L. GREENE, *Electrical Engineer, Gilbert Associates, Inc., Reading, Pa.*

Jennison Station outdoor 46-kv. and 13.8-kv. buses and indoor 13.8-kv. isolated-phase leads and housing of aluminum—Special attention to connectors and bolting for prevention of corrosion—Both pipe and channel used —Aluminum for housings

ALL POWER generated at the new Jennison Station of the New York State Electric & Gas Corp. is transmitted by aluminum buses. This includes all outdoor 46-kv. and 13.8-kv. buses and indoor 13.8-kv. isolated-phase leads between the generator, transformers and main switchgear.

This installation was made during the years 1944 and 1945, which was during a period of critical material shortage. Due to the greater availability of aluminum than copper, WPB favored the use of aluminum which, combined with engineering and economic reasons, led to the use of aluminum for the main buses.

The 46-kv. switching structure (Fig. 1) consists of three double-ended bays each 18 ft. wide providing facilities for the equivalent of six outgoing circuits. Switching facilities include provisions for operating from either bus in addition to oil circuit breaker isolating and bypass switches. All switch connections and bus taps were made with Aluminum Co. of America No. 2-s standard, $\frac{3}{4}$-in., I.P.S. aluminum tubing, with 2-s standard, $1\frac{1}{2}$-in., I.P.S. aluminum tubing for the two main buses. All-aluminum 795,000 cir. mil cable was used for taps to the oil circuit breaker bushings to provide flexibility between the porcelain bushing and the structure. This same size cable was also used for the main connection between the transformer structure and the 46-kv. switching structure, a distance of about 240 ft.

Aluminum Connections

All aluminum to aluminum connections were made with Burndy and R. & I. E. Co. cast aluminum alloy connectors having No. 24S-T high-

tion being taken up by the flexible connections at the wall of the plant. The lower section terminated at the end of the structure with the movement, at the taps to the transformers, being provided for by two $\frac{3}{16}$- x 4-in. aluminum bars 4 ft. long. Taps to the transformer were made with one channel in the horizontal position extending to the outside of the structure above the 13.8-kv. bushings. Taps to the bushings were made with two parallel pieces of $\frac{3}{16}$- x 4-in. aluminum bar having two 90-deg. bends to provide flexibility between the porcelain bushings and the structure. All connections were made as previously described using NO-OX-ID compound to maintain a good electrical joint.

Isolated Phase

The indoor 13.8-kv. isolated-phase leads consist of three main sections, namely:

Switchgear to generator terminals.

Switchgear to station service transformer.

Switchgear through building wall to the outdoor bus.

The isolated-phase bus, constructed by the I.T.E. Co., consists of a conductor (tube), supported on four porcelain insulators mounted on a supporting ring, the entire assembly being encased in a circular metal housing. Three of these assemblies mounted side by side, leaving an air gap between each housing, provides a 3-phase circuit of high mechanical strength and reliability.

This installation features the all-aluminum construction of these isolated-phase leads, all metal parts being made of aluminum, the two main sections being 2,000-amp. capacity while the leads to the station service transformer are 1,200-amp. capacity, all designed for 1,000,000-kva. short-circuit stress.

The 2,000-amp. conductors are $3\frac{1}{2}$- x $3\frac{1}{2}$-in. square aluminum 2S tube with $\frac{3}{8}$-in. wall, the 1,200-amp. bus being 2-in. I.P.S. tubing. Taps were made from the generator leads to the potential transformers in the switchgear using 2-in. I.P.S. aluminum tubing. No particular attention was paid to the indoor joints between aluminum and copper due to the absence of moisture, all being made with cadmium-plated copper bars and $\frac{5}{8}$-in. high tension steel bolts using Belleville spring washers. The supporting rings are heat-treated aluminum alloy casting having a tensile strength of 30,000 lb., these rings providing support for the insulators, the enclosure and facilities to mount the completed assembly in the power house. The enclosure is made of 2S half hard aluminum sheets 0.102 in. thick, rolled to form a circular housing 17 in. inside diameter. The sides of each half are formed to accommodate a gasket and provide bolting facilities for assembly, and vary in length from short formed elbows to straight lengths up to $7\frac{1}{2}$ ft. long. The ends of these formed sections rest on gaskets provided in the supporting rings with a thin fibre insulating strip at one end to minimize sheath currents and eliminate the necessity for ventilation, thereby providing a dust and weather tight enclosure.

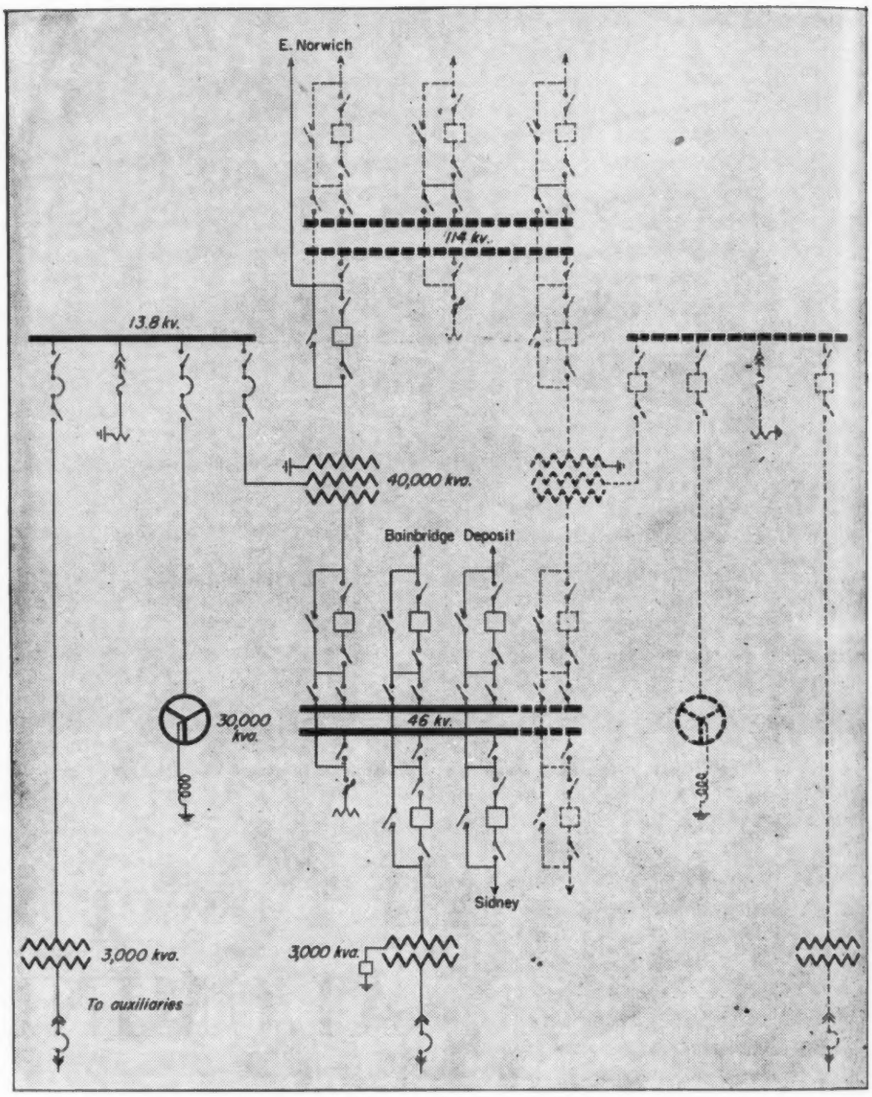


FIG. 4—One-line diagram of Jennison Station shows relation of 114-, 46- and 13.8-kv. buses. Dotted lines indicate provisions for future

Additional box-type enclosures were also constructed of aluminum sheets to house the current transformers at the generator terminals, the neutral reactor directly below the generator on the basement floor, and to cover a section of the leads above the generator floor.

Main transformer leads ascend the inside wall of the turbine room to the end of the bushings in the wall a few feet below the crane rail. They are carried through the wall, with Locke 33-kv. bushings, to the main transformer bus on the inside, making this connection with flexible braids.

The outdoor structures were completely designed and detailed by Gilbert Associates, Inc., who designed, engineered and supervised the complete project.

strength aluminum alloy bolts with self locking nuts, the locking device on the nuts being a stainless steel wire inserted in the nut by the Automatic Nut Co. to prevent the nut from loosening. The complete bolt and nut has an anodized finish with the threads coated with Alcoa thread lubricant. Aluminum to copper connections were made in some cases with tinned copper and in other cases with copper-plated aluminum to eliminate as far as possible any electrolysis between the copper and aluminum.

To further prevent electrolysis, all joints were thoroughly cleaned with nitric acid (70 percent concentration) and covered with a heavy application of NO-OX-ID compound. After applying this compound to the aluminum bus, the surface was roughened with a wire brush to break up the oxidation on the surface of the aluminum, the compound being left on the surface after brushing and the connector installed, using torque wrenches to insure proper tension on the bolts.

Head clamps on all bus supports, for support of the main buses and taps, were made of cast aluminum alloy by the Electric Power Equipment Co. and are designed to provide facilities for anchoring the bus or allow it to slide to accommodate expansion.

The transformer structures provide facilities for the 13.8-, 46-, and 114-kv. buses for the three 10,000-kva. self-cooled, 13,333-kva. forced-cooled, three-winding transformers with provisions for a fourth or spare transformer.

The 114-kv. connections from the transformers are made to a single 114-kv., 3-phase strain bus located above and on the high side of the transformers. The neutral bus is made of standard $\frac{3}{4}$-in., I.P.S. aluminum tubing carried along the top of the low side bus structure with taps to the 114-kv. neutral bushings using $\frac{3}{4}$-in., I.P.S. aluminum tubing and flexible connectors. The 46-kv. transformer bus uses $1\frac{1}{4}$-in., I.P.S. aluminum tubing with $\frac{3}{4}$-in., I.P.S. aluminum tubing, and flexible connectors for taps to the 46-kv. bushings.

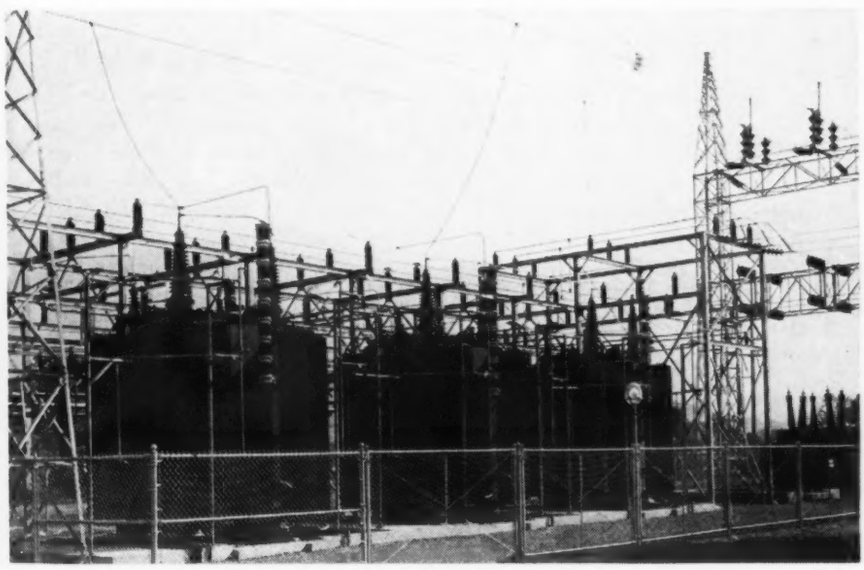


FIG. 2—114-kv. neutral bus of aluminum tubing with flexible connectors

FIG. 3—Isolated-phase bus entirely of aluminum including rings and housing. Main section has 2,000-amp. capacity. The observer is the author

Channel Buses

The 13.8-kv. bus, from the wall of the plant to the transformer terminals, is made of Alcoa 4-in., 1.84-lb. aluminum channel conductors using $\frac{5}{8}$-in., high strength 24S-T aluminum bolts and flat bar. The main section of bus is constructed of two channels assembled face to face in a horizontal position with a spacer between the channels to obtain a 4- x 4-in. overall assembly which leaves a space between the edges of the channel for ventilation. It was found advisable, due to the long bus support spacing, to assemble this bus in the horizontal position in order to obtain sufficient strength to resist the short-circuit stress on this bus. With the installation of two spacers in each span, this assembly was suitable for heavy ice loading conditions without excessive deflection of the bus. One T and one 90-deg. angle was made in the main bus run to change elevation, these connections being made with $\frac{1}{2}$- x 4-in. flat aluminum bar, solid aluminum spacer blocks and $\frac{5}{8}$-in., No. 24S-T aluminum bolts.

Main bus is supported with streamlined cast aluminum head clamps made by the Electric Power & Equipment Co. with provisions for anchor or slip-fit connections. The two sections of bus were anchored at the vertical connection point allowing expansion the full length of both sections, the expansion of the upper sec-

Boston Edison Benefits from

ALLAN B. JONES, *Transmission and Distribution Department, Boston Edison Co.*

IN ADDITION to the electrical design and economic aspects which have been well publicized in engineering literature, the use of the common neutral involves a number of interesting construction and operating features. On the Boston Edison system the main features of common neutral construction are:

1. A reduction in the number of wires carried on the top crossarm, permitting double spacing of phase wires. This is an important improvement which involves several operating advantages which pay continuous dividends.

2. Construction and connections are simplified by solidly connecting the neutral wire straight through as a grounded grid. This eliminates one pole from switches, removes the neutral fused cutout from transformer installations and does away with the 2,400-volt neutral lightning arrester.

3. In underground construction the cable sheaths are used to improve the neutral ground grid and as neutral returns.

4. In new underground construction, one cable is eliminated. Cables already installed are not ordinarily retrieved, but are used as spares, neutral return paths, additional phase conductors or simply to parallel the other common neutral copper.

Neutral Studs on Transformers

While it would be possible to simplify transformer construction by eliminating primary neutral bushings of overhead transformers or the neutral wiping sleeves of subway units and substituting neutral studs, this has not been deemed practical for several reasons:

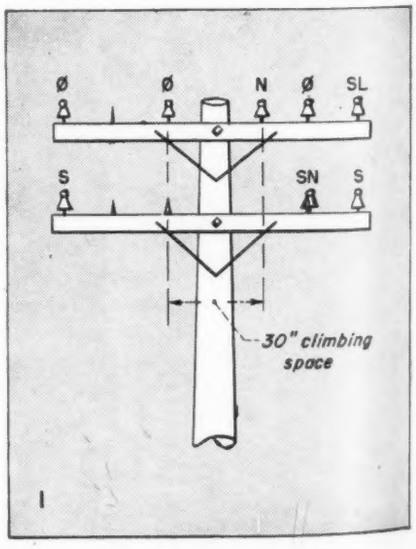
(A) Stud neutrals are not usable on station grounded circuits or on 2,400-volt delta system; (B) Position of phase wires varies, requiring phase connection on either bushing; (C) Single bushing transformer is not standard on market; (D) Transformer testing and checking in the reconditioning shop is made more difficult, and this alone could easily cost as much as the saving in the bushing; (E) External, visible connections to transformers on the line are desirable for operating purposes.

Steps in Conversion

In establishing the common neutral in a circuit, certain definite steps are necessary to carry out the project safely and consistently. The normal position of the common neutral is in the lower position with the secondary wires or cables. During the conversion period the common neutral wires or cables often consist of a former secondary neutral connected in parallel with the old primary neutral, in which case the secondary neutral will become the common neutral. After conversion the surplus wires in the primary position are removed or otherwise utilized.

Step 1 in the conversion is to tie all the secondary radial neutral wires together into a continuous secondary neutral grid. Insulators strung between radial neutral wires are removed and spans of wire strung between adjacent radials. If no secondary is present on the poles, separate 1-wire brackets are used to carry the conductor. An average of one span of neutral wire per six spans of secondary is required to make the neutrals continuous in urban and suburban areas. In rural areas this ratio is three new spans to six of the secondaries. Insulators are used on all brackets or pins for mechanical reasons. A large radius attachment is required and glass and porcelain provide the most economical material. On underground secondaries the cable sheaths are all bonded together, and where a single sheath is to serve as the return path, all joints are jumpered with bonds. Neutral secondary coppers are connected together.

FIG. 1—Old arrangement of pole using 6-pin crossarms for 3-phase primary, one series street lighting wire and a 3-wire secondary circuit. While this is not a congested pole, double-spacing of 2-phase wires has already been accomplished, though single spacing still exists between the third phase wire and the primary neutral. Station grounded neutral used



* From a paper before the Boston Section, A.I.E.E.

Common Neutral Practice*

Conversion 75 percent completed after 7 years' work—

Notable reduction in both overhead and underground primary troubles attributed in part to this practice—

Faults stronger but more readily located—Tree trimming imperative

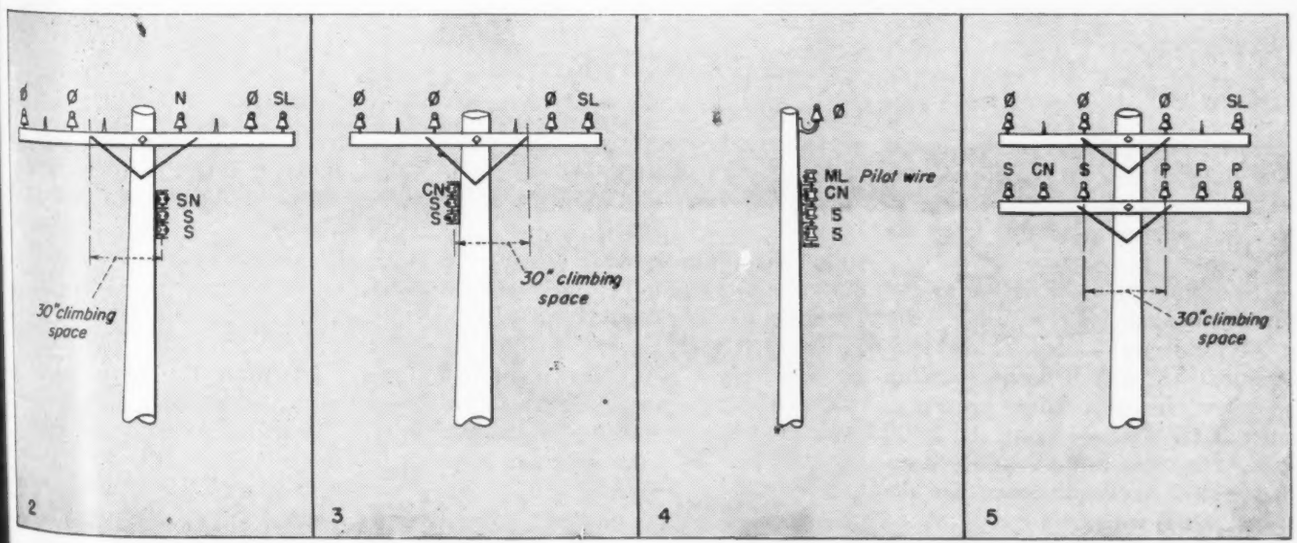
Step 2 is to see that the requirements for effective grounding are adequately met. Grounding conditions specified by the National Safety Code are more than exceeded by this company's practice. The two metallic return paths are checked for continuity. All disconnecting devices are removed from neutrals by bypassing the neutral poles of switches and removing neutral disconnects. Where additional line grounds are required, insulators are removed from anchor guys and bonds are run to the secondary neutrals. Customer grounds are checked for number and continuity. Loose grounds are cleaned and securely tightened, additional line grounds being installed where necessary.

After all requirements have been met, the existing primary neutrals are connected to the secondary neutrals at each single-phase transformer and at junction points, thus operating the former primary and secondary neutrals in parallel as common neutrals. Later the old primary neutral may be used as part of the second metallic return, as a spare cable, as a new phase conductor, for expansion of a single-phase line to 3-phase, or it may be removed. Cutouts and lightning arresters on the old primary neutral are removed. Boosters, if present, must be cut in with the boosting coil in the phase wire instead of in the neutral as was formerly the case. In underground work it has long been the practice to bond secondary neutral copper to the cable sheaths, and in converting to common neutral it is only necessary to connect the primary transformer neutral leads to the common neutral, leaving the old primary neutral in parallel with it. At all standpipes the cable sheaths are bonded to the neutral conductors and to the standpipe itself.

The use of the common neutral for series street lighting circuit returns is an outgrowth of the common neutral. Conversion of 2-wire series street lighting loops into single-wire lines has been going on for several years. An established common neutral along a series line lends itself very well to the elimination of the second series lighting wire or cable by acting as a return where a double wire line would otherwise be necessary.

After the common neutral system is

FIG. 2—Present standard with 8-pin crossarms and secondary racks. Station grounded neutral used. . . FIG. 3—Common neutral construction, lighting secondaries only. Neutral wire removed from top arm and phase wires spread well apart. Six-pin arms used. Pole pin vacant to provide climbing space past rack. . . FIG. 4—Common neutral with single-phase bracket construction. . . FIG. 5—Common neutral construction for both lighting and power secondaries, requiring a 6-pin crossarm for secondaries



established, a light simplified single-phase residential construction is made possible in areas where the grounding possibilities are acceptable. This construction is neater in appearance than standard crossarm construction. It consists of a phase conductor at the top of the pole with a 4-spool secondary rack to carry three secondaries and a multiple street lighting control wire. The multiple street lighting wire is energized only in the daytime by a time switch, and street lamps are controlled by pilot wire relays. This type of construction (Fig. 4) has a promising future.

Operating Features

The Boston Edison system has progressed steadily from 2,300-volt delta to 4,000-volt wye underground neutral, thence to station grounded neutral and finally to continuously grounded common neutral. The 4-wire parts of the system are now 80 to 90 percent converted to common neutral and the 2-wire, single-phase areas are 40 to 80 percent converted. Each step brought some changes in operating features.

With the delta and ungrounded wye system, phase-to-ground faults were not severe and on occasion a circuit would be operated with one phase grounded until the fault could be located. Intermittent or "swinging" grounds were frequent. After the neutrals were grounded at the stations these practices ceased. Phase-to-ground faults were more definite and caused more arcing and fusing because of increased fault current. Good tree trimming became more necessary and increased clearances were shown to be of value. Locating faults became simpler because the troubles made themselves more apparent. The more solid grounding of the common neutral increased still more the possible fault current. Types of construction which operated satisfactorily on ungrounded primary circuits no longer stand up and must be improved. It has been observed that with the common neutral, faults burn themselves clear more quickly or cause station breaker operations, thus decreasing the duration of unsafe arcing conditions.

Tree contacts are definitely our greatest source of trouble on overhead primary lines. The double spacing made possible by the common neutral system reduces exposure to phase-to-phase burning by fallen limbs. The burning at contacts of a limb lying across wires spaced 28 in. apart is very much less severe than when the limb spans only 12 in. The limb often lies across the wires until it falls clear without causing trouble. Similarly the exposure to single-wire and tree contacts is decreased because the additional wire space on the crossarm allows more flexibility in shifting wires to avoid trees. The increased wire spacing decreases the exposure to a third type of tree trouble, that of two wires being pushed together by heavy limbs.

Operating Results Good

Trouble with open primary neutrals, once not infrequent, has almost disappeared with the coming of the common neutral.

Improved line operation with respect to lightning followed the construction of the improved grounded neutral grid. The trouble rate has been at a comparatively low value for several years.

Working methods of linemen are somewhat affected by common neutral operation. They are now instructed to use more rubber protection on neutrals, secondaries and grounded structures. Protective covering of the grounded conductors and structures was formerly not generally practised by most linemen. An increased respect for secondaries is being developed. The double spacing of wires and reduced congestion on the poles affords clearer climbing and working spaces. Underground operators now do more sectionalizing before entering manholes where there is trouble, because of the greater amount of energy liberated on short circuit in case of a manhole flash.

The economies in new construction are apparent. Reduction of one wire in a line is a substantial saving, and where the construction can be radically simplified, material and labor costs are reduced.

Operating records over the past ten years show a consistent decrease in trouble rates. This decrease is attributed partly to common neutral and partly to other improvements effected during this period. Conversion to the common neutral system began in 1938 and is now about 75 percent completed. Here are the trouble reductions:

	Overhead Primary Troubles	Underground Primary Troubles
Average per year, 1933 to 1937	1,342	92
Year 1944	860	50

• • •

Speed Control by Frequency

J. A. WASMUND, Marine Engineer, Westinghouse Electric Corp. East Pittsburgh, Pa.

Thirteen Coast Guard cutters, almost entirely Westinghouse equipped, are the first a.c. turbo-electric vessels to have full automatic control from the pilot house.

The main turbine is of the single-flow impulse-reaction type, using steam at 600 psi. gage, 750 deg. F. total temperature. Through a flange coupling it drives the propulsion generator, rated 3,200 kw., 3-phase. At 5,400 rpm., it supplies 2,400 volts at 90 cycles, which gives full power for the propulsion motor.

The synchronous propulsion motor delivers 4,000 shaft hp. at 180 rpm., which corresponds to 5,400 generator rpm. Its speed is controlled by varying the generator speed. Normally, the field circuits of the two machines are in series across a common exciter.

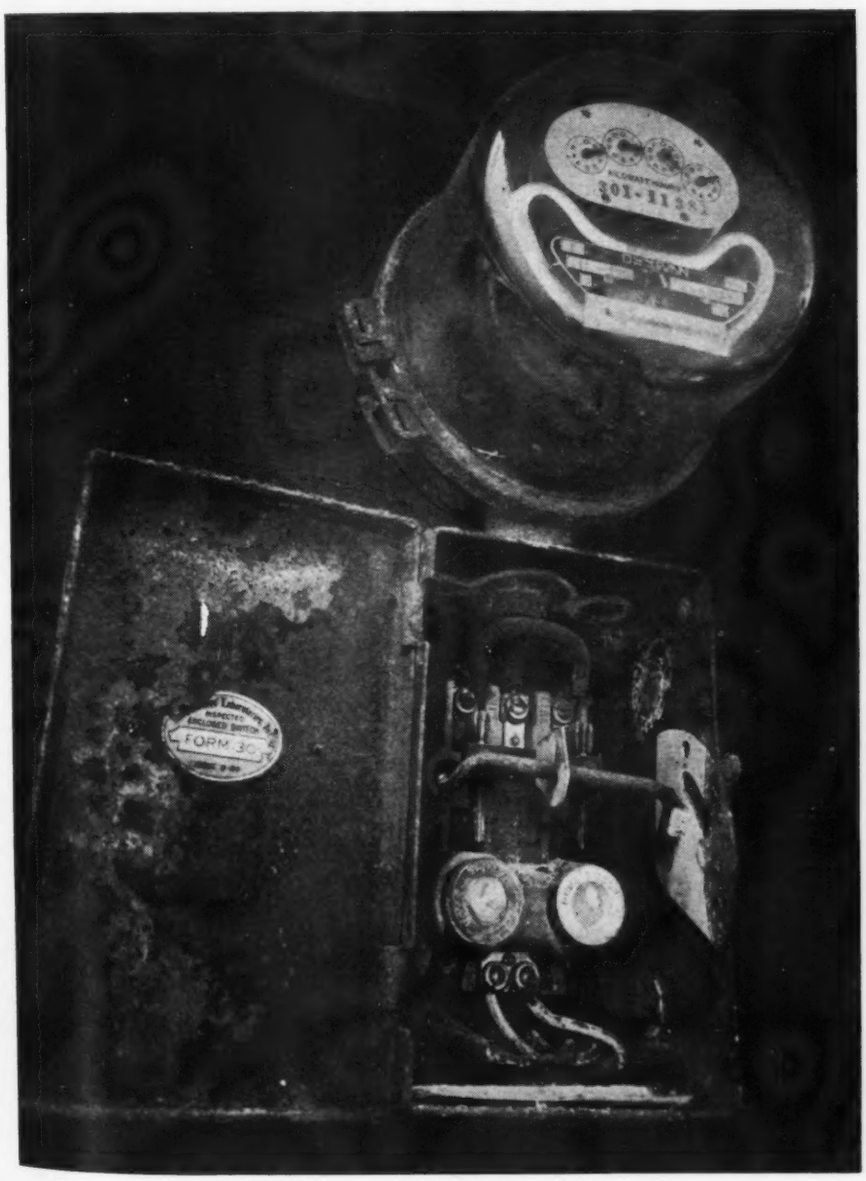
Boiler feed pump, forced draft fan, main circulating pump and propulsion motor fans are supplied from a variable-frequency bus energized through a 125-kva., 2,400/600-volt air-cooled transformer designed for a frequency range from 90 cycles to 15 cycles. Equipment on the auxiliary switchboard will transfer them from the transformer secondary bus to the 450-volt 60-cycle ship's service bus either manually or automatically when the transformer voltage drops below a certain value. Satisfactory operation can be obtained on the constant-frequency bus up to two-thirds top propeller speed, which corresponds to 60 cycles on the propulsion bus. Above this point transfer must be made to the variable-frequency bus to obtain sufficient speed of the auxiliary motors.

CORROSION

of Watthour Meters in Ocean Beach Areas

A. D. IRION and R. M. STEVENS, *Shop and Test Division, Southern California Edison Co., Alhambra, Calif.*

West Coast utility finds meter bases and service equipment badly corroded by salt-laden moisture in beach areas—Salt spray tests supplemented by tests on exposure rack at beach—Stainless steel to be tried—Problem not confined to southern California—Anodized aluminum cases promising

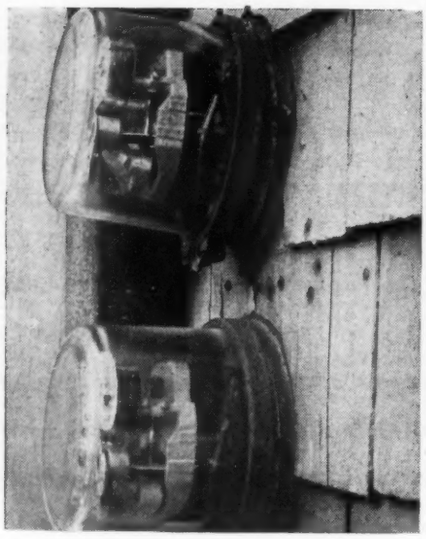


A—Recessing of meters does not alleviate problem. Sealing ring is badly corroded and bolt cutters will have to be used to remove ring. Glass cover is cracked from pressure of corrosion salts

LATE IN 1944 an assorted group of type A single-phase watthour meters was sent to the meter shop of the Southern California Edison Co. for repair. Several meters were observed to be in such state of corrosion that replacement of bases, terminal chamber covers and other parts was necessary. In many cases the glass covers were broken and it was found that the metal cover ring was so corroded to the meter base that it could not be removed without damage, or in some cases actually breaking the base, making it unfit for further use.

Corrosion appeared to be of two kinds: that due to the disintegration of metal parts as a result of salt-laden moisture, causing metal salts to be formed from contact with the aluminum alloy bases, and that due to galvanic action from dissimilar metals being in close proximity in a moist salt-laden atmosphere. As all of the meters were of comparatively recent manufacture, it was apparent that unless corrective measures were taken, meters would be short-lived.

The Edison company has always been aware of the detrimental effects of corrosion on any exposed metal in beach areas, but the advent of the modern type A and type S meters has made the problem more acute. In 1940 extensive tests were made in the company's



B—Corrosion is pushing top meter out of socket. Base inside meter is badly rusted and parts corroded. Lower meter affected similarly

C—Example of corrosion damage to customers' service entrance equipment. Meter cannot be serviced and if removed may be beyond repair

D—A-type meter base is completely ruined after two years' service in beach area. Resistance to corrosion by painting is indeterminate factor

salt-spray booth to determine the most suitable finish that could be applied to meter bases to protect them from the corrosive action of salt spray. Meter manufacturers were most cooperative and sent sample meter bases with various protective coatings. Although the investigation was far from completed at that time, definite progress was made. In 1941 each manufacturer began furnishing the company meters with some type of protective finish on the meter base. Material shortages during the war made it necessary to use substitute materials in the manufacture of meters. Meters had to be accepted regardless of materials or finish. During this period meters were installed in exposed locations, not only with inadequate protective finish but with exposed parts made of materials that were very susceptible to corrosion. Early in 1945 a few installations were inspected at random and photographs taken. Those accompanying were selected from these and others taken in the shop.

Some Conclusions

Corrosion problems on A- and S-type meters are similar and neither type has an advantage over the other from the standpoint of corrosion difficulties. The problem is not confined to any one particular make of meter. Corrosion is but little minimized on recessed or protected installations where meters are installed close to the surf and subjected to salt-laden atmosphere, if even a small amount can enter the meter recess or enclosure. Unpainted meter bases are most susceptible to corrosion. Resistance to corrosion provided by painting is an indeterminate factor and the actual added useful service of a painted meter base is yet to be established.

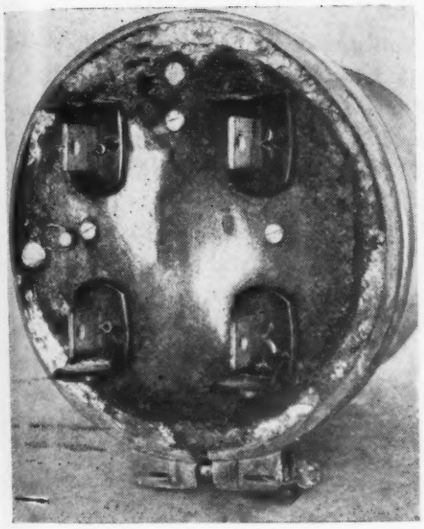
In areas within $\frac{1}{4}$ mi. of the surf, the problem of corrosion is most apparent. Corrosion of modern meters in a period from $1\frac{1}{2}$ to 5 yr. may progress to such a point that removal of the glass cover for replacement, or meter servicing, will be difficult. Also removal of the cover will present a personal hazard to the employee. Corrosion on type S meters in a relatively short time can gradually force the meter out of the clips in the meter socket. This permits water to enter the socket, presenting a hazard to continuity of service and a personal hazard to the meterman.

The problem of replacing a meter on either A- or S-type installations where the socket or meter loop pull box has deteriorated and cannot be used will be increasingly serious as time goes on. In general, the socket or meter loop pull box is the property of the customer and the company may require replacement in order to meter the service properly. On both type A and type S, where the cover ring is of different material from the socket or meter base, galvanic action will in a short time make it impossible to remove the meter cover. Pressure caused by the salts formed by corrosion crack the meter cover and require that the meter be returned to the shop for extensive repairs. Repair is sometimes uneconomical where corrosion has definitely started and where replacement of essential parts is necessary. Many such meters have had a useful life of only $1\frac{1}{2}$ to 5 yr.

Galvanic Action

Wherever brass screws are in contact with the aluminum alloy base, galvanic action progresses rapidly in a salty atmosphere and when an attempt is made to remove such a screw, shearing off of the screw usually takes place. On some makes of meters there are as many as seven such screws which are in contact with the meter base. On type A meters there are four such screws accessible from the outside of the meter; two holding the terminal block in position and two holding down the meter terminal chamber cover. In the event a meter is changed from one location to another, the shearing off of either terminal chamber cover screw necessitates the return of the meter to the shop for repairs.

On type A meters, the die cast adapter with high zinc content and of company design, installed below the meter, aggravates the corrosion problem. Not only is the adapter itself subject to corrosion but the galvanic action between the two small nickel-plated brass sealing screws and the adapter cover invariably shear, neces-



E—Flange of meter socket is completely deteriorated from salt moisture corrosion and galvanic action between dissimilar metals

sitating the replacement of the adapter. Service units purchased by customers to house indoor type A meters and overload breakers deteriorate to such an extent in beach areas that neither the breaker compartment nor the meter compartment can be opened except by force. Where corrosion has deteriorated the sealing provisions, the original purpose of a sealable meter compartment is defeated.

Method of Attack

Recently manufacturers' representatives were sent from the factories to the West Coast to get first-hand information on corrosion problems. In every case they expressed surprise that action was so severe. Probably the reason that the conditions are more severe on the Pacific Coast than on the Atlantic is that the direction of the prevailing winds on the West Coast is from the ocean. Also in southern California there is no rain during about eight months in the year to wash the salt and dirt off the meters.

Study of corrosion prevention is continuing. Sample meter bases are being tested in our salt-spray booth and also at the beach. A test rack has been installed on top of a one-story building at Redondo, directly on the beach. This rack has been in use for approximately four months and already a number of samples have been eliminated as undesirable. Corrosive action on samples in the salt-spray booth is an accelerated test but does not simulate conditions encountered on the test rack. There, a combination of salt spray with cool damp nights and hot sunshine during the middle of the day gives a severe cycle of exposure.

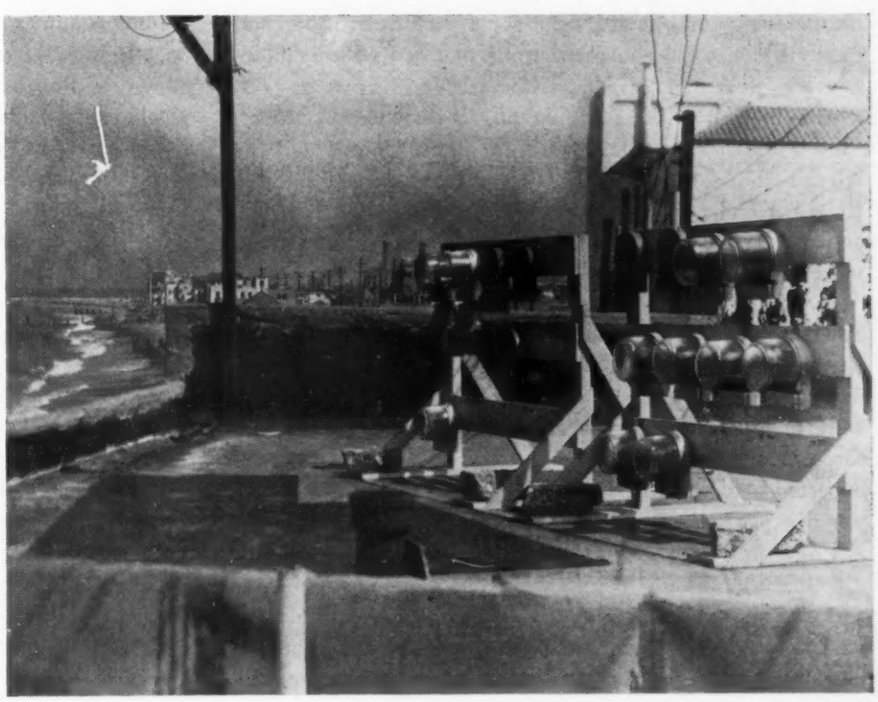
Type A Meter Tests

Recent tests have been made with A-base meters because at present this type of meter is preferred rather than the socket type for exposed installations in beach areas. Although both types are seriously affected by corrosion, there is less likelihood of the customer having to replace his service equipment when using type A. With the socket type, it has been found that corrosion is so severe due to the salt air and the galvanic action of dissimilar metals that corrosion salts build up and force the meter out of the socket, often taking the flange of the socket along with the meter and necessitating the replacement of the socket.

Manufacturers supply our company with A-base meters that have a full gasket under the terminal chamber cover with a screw on each side to make the terminal chamber rain tight. When the terminal chamber is protected in this manner, the A-base meter is suitable for installation out of doors. In testing materials suitable for installation in beach areas, it is necessary to test the complete meter unit rather than a particular part that has been specially treated. The action between dissimilar metals makes it necessary to consider all the exposed metal parts. Although definite conclusions cannot be made at this time, test results to date indicate that an A-base meter that has all exposed metal parts made of aluminum, anodized by the sulphuric acid process and painted with a coat of air dry lacquer, is a good combination. Such meters when exposed in the salt-spray booth for 115 hr. to salt spray and an additional 264 hr. standing wet, making a total of 379 hr., or when installed on the test rack for four months, show no evidence of corrosion. Meter manufacturers are making further studies and will supply additional samples for test, including socket meters with the base plate, cover ring and sealing band of stainless steel. The company will continue its investigation, augmenting tests in the salt-spray booth and on the test rack with data obtained from service installations.

The problem of meter corrosion and steps taken have been presented in the hope that publicity may aid in its earlier solution. Similar corrosive conditions exist all up and down the Pacific Coast and to a lesser degree on the Atlantic and Gulf seaboards, so that the problem is not local to southern California.

F—Meter test rack on roof of building in beach area. Various metals with different coatings are undergoing corrosion tests



EDITORIALS

S. B. WILLIAMS, *Editor*

Restrictive House Construction Practices Need Review

WHAT will the housing program do to accepted practices and industry standards? These questions have not been decided, but it can be certain that restrictive practices that have as their principal effect the obtaining of more money for part of the construction industry without any visible benefit to the purchaser will not be accepted as easily as they have been in the past. Some of the restrictions exist in the electrical industry.

In the National Electrical Code itself there has been an increasing tendency to get away from minimum safety, particularly when considering some new device or method, nor has the situation been improved any by the stronger voice of labor on the revising committee. On top of that, however, are still further restrictions in the form of special rules by local inspection bodies. In these instances, it cannot always be said that the restrictions are put on to benefit any special building trades group, for many inspectors are sincere in insisting that the public be protected against certain hazards. And then there are utility requirements that are written from the standpoint of protecting the company that might bear some reconsideration, and finally there are union restrictions that are nothing more nor less than make-work provisions.

This housing shortage apparently is serious everywhere. This is no time for make-work. We need houses and the labor to build those houses. It would be splendid if the electrical and every other branch of the building industry could eliminate all restrictions that cannot be demonstrated to be definitely beneficial to the owner or occupant.

If this is done, perhaps enough will be saved to permit the buyers to enjoy the industry standards of adequate wiring and lighting, and thereby be able to have the comforts and conveniences of modern living. If these houses were to be but temporary affairs, to last but for two or three years, the advantages of electrical living might be expected to give way to the emergency, but these are supposedly permanent.

Under those circumstances it would be grossly unfair to give the veterans just plain subsistence housing when comfort and convenience are available. The electrical industry also has a stake in housing that is in the interest of future customers. The time to get things settled is now.

CPA to the Rescue

DURING the war the utilities on numerous occasions when critical supply situations arose had reason to be grateful for the assistance of OWU in preventing restrictive measures that would have hamstrung them in their efforts to give full service at all times. How many utilities, we wonder, are aware that the same watchfulness over their interests still exists in the Civilian Production Administration, the successor to WPB. How many realize that but for the efforts of the CPA utility representative, whose office is all that remains of the once large OWU, the recent construction limitation order might have been lots more troublesome?

While there is some paper work left, it is nothing compared to what it would have been had the ban on line construction that was in the first draft of the order not been removed, as well as the inclusion of substation equipment in the $15,000 building exemption that was in a later version. As the order now stands, it interferes to a minimum with the utility construction program.

Although the war is over there still remain many war-born supply and equipment problems some of which may become more acute before the year ends. It was to assist industry, by order or informally as conditions demanded, that CPA was set up to carry on after WPB went out of existence. Although few utilities have called on it for assistance, its efforts on the construction order fully justify its continued existence.

Inside Wiring Is Part Of Distribution

ADEQUATE WIRING promotion material and plans are again available for use of local associations and committees. Utility company interests in the program are at first glance largely commercial. It is easy to recognize the relationship of adequate wiring and the addition of kw.-hr.-using appliances. But the job is too big to pass on by assignment solely to the commercial men. It calls for broad support in other branches of operation also.

Interior wiring is in fact, a part of distribution because amperes cannot recognize the convenient dividing line of a service entrance or meter board. Wiring must not escape its share of scrutiny in the engineering of primaries and secondaries. Blotches are put on the best continuity and voltage betterment programs when flickers, blown fuses and tangled extension cords interfere with customer satisfaction. Complaints and trouble calls are clues leading to these bottlenecks in distribution.

Service and distribution departments probably are willing enough to leave the company part of adequate wiring promotion in sales and advertising hands, but for the long pull, they must have a more active part in extending the program. A general study and solid support will help, and an appraisal with voltage and service perspective may be an asset to the local program committee along with the commercial interest.

Heat Balance Scale Is Tipping

GENERATION of electricity as a byproduct of process steam has been for years and is now one of the stiffest competitors of purchased power. Industries using steam for process heating in any considerable quantity could and can in many cases meet all or part of their electrical requirements by local generation at costs much below rates possible to any utility. Thermal efficiencies in utility power plants averaging nationally around 1.3 pounds of coal per kilowatt-hour, accompanied by costs and losses of getting the energy to the user, have compared poorly indeed with possible byproduct generation at allocated fuel ratios down to half a pound or less of coal per kilowatt-hour.

Now the situation is changing. The pointer of the heat balance scale no longer rests so firmly on the local generation side. It is beginning to move towards the other side. Two modern developments in electric heating are adding much weight in favor of purchased power. They are infrared and dielectric heating, each finding new and larger uses in production processes.

Steam is used for heat application in processes of cooking, melting, drying, warming and chemical reaction. Many of the processed materials are of organic nature, foods, plastics, textiles, wood, etc., and the temperatures required are not high. To the particular circumstances of many of these processes, infrared or dielectric heat may be found to be peculiarly adaptable by reasons of more accurate temperature control, faster heat penetration, more flexible utilization of equipment, better production technique, improved working conditions, and other considerations that often have values only in individual cases.

This penetration of electric heat into the process steam field is already well under way. Not always, perhaps not even frequently, can its displacement of steam be justified in mere dollars-and-cents accounting that is confined strictly to the operation concerned.

As electricity displaces steam for process heating, so, proportionately, does the range of economy of byproduct power supply shrink. Here is another reason, if another is needed, for utilities to be enthusiastic about the load-building potentialities of electric heat in industry.

Ash Content of Coal

POWER PLANT OPERATORS had their troubles with coal during the latter stages of the war because of the poorer quality supplied to them. Insofar as that experience was due to increased ash content it carries some lessons that cannot be ignored, particularly if the increased ash content is destined to be a continuing or even increasing factor.

Burning coal with more ash has several ramifications outside the mere problem of achieving satisfactory combustion and conditions within the boiler and furnace. Admittedly there is more slag and flyash within that area. Also more tons of the lower grade material have to be freighted, handled, stored and pulverized. More or larger devices will be required to remove the ashes under the furnace or at the entrance to the stack. Conveyors, pulverizers, dust separators, sluices, all must be given added consideration if the percentage of ash stays or moves up.

Fully as important as any of the above items is provision for disposal of the non-combustible. Some day research may create a practicable use for bituminous ash, but until it does there will be the problem of disposing of it, which will entail adequate space in which to dump it as fill. Some plants have already found their low land filled up several years ahead of expectation and new disposal pockets at more remote points are necessarily resorted to. Plant sites will last the life of the equipments in them only if they afford a place to get rid of the unburnable stuff that gets shipped from the mines along with the Btu.

Decontrol Brings No Runaway Prices

MANUFACTURERS of heavy electric equipment lost no time in taking advantage of OPA decontrol of prices. An increase of 15 percent seems to be fairly general as was indicated might happen in the survey on relationship of wages and prices that appeared in our March 23 issue.

It is known that in most instances this increase will not cover the higher cost of labor and materials, and unless improved efficiency is forthcoming soon it may be that further advances will have to be made. It is for this reason that escalator clauses will continue to be used.

The manufacturers gave evidence on every hand of a desire to keep prices as low as possible and the present small increases can be taken as evidence that they will not take full advantage of their position in a seller's market. That there have been no runaway prices as the result of decontrol of capital goods may perhaps give OPA a little more confidence in American industry.

Labor, which has appeared so concerned over inflation while it was making its demands for high wages, now has the opportunity to evidence the sincerity of its position by providing productivity at a rate that will enable the manufacturer to sell gainfully without further price increases. Wherever we turned in our inquiry we were met with the same statement, namely that even these present price increases could not be maintained unless there was cooperation from labor. Some reports from plants that have returned to work after being out for a considerable time on strike seem to indicate that productivity per worker is better than it was before the strike. This is a most encouraging sign.

So far, the decontrol has affected only a part of the non-consumer goods output of electrical manufacturers. While there is no indication that the remainder will be decontrolled immediately, the manner in which prices so far have been handled by the manufacturers should encourage OPA to lift controls on electrical capital goods without undue fear of excessive prices.

WASHINGTON COMMENT

By R. N. LARKIN Washington Correspondent

SEC Reluctant to Take Part in Public vs. Private Power

THAT PART of Washington which pays any attention at all to matters concerning the electric power business is witnessing the rare spectacle of a Congressional committee attempting to thrust additional jurisdiction upon an unwilling administrative agency.

The Congressional committee is the Boren subcommittee of the House Interstate and Foreign Commerce Committee which has, since last July 12, been probing into operations under the Public Utility Holding Company Act of 1935. The resultant agency is the Securities and Exchange Commission. The additional jurisdiction which has been suggested for SEC as a result of the hearings is twofold:

1. That SEC would be given the right to regulate fees paid by public bodies in the acquisition of electric properties from non-public owners.
2. That SEC would be given authority to investigate non-political, non-operating expenditures by holding and operating companies in support of various issues.

Purcell Backs Away

As soon as he heard about this, Chairman Ganson Purcell of SEC backed away determinedly.

SEC, Purcell made it unmistakable, is not the agency to perform either of these functions, for, according to its chief, it has not been, is not and should not in the future become involved in the struggle between public and private ownership currently raging within the industry.

"To adopt federal legislation which would give a federal agency the power to tell a state or local government that it may not pay whatever fees in the purchase of local utility properties it deems desirable would, in our view, raise serious questions of constitutional power and constitute an important change in federal-state relationships which would have to be considered very carefully before any such precedent is established," Purcell told the subcommittee.

Adding that if such a policy were to be adopted by Congress, SEC would want no part of administering it, its acts already having been drawn so as to leave the agency free of the public-private ownership dispute, Purcell declared:

Wants No Public Power Function

"In order that the Commission may carry out this function (divestment of unretainable properties) with the necessary confidence of affected parties and the general public, and to preclude any possible question arising of a commission decision under Section 10 or 11 having been affected or colored by bias on the public power question, we think that the Commission should not be assigned any public power functions or any functions which could draw the Commission into the public power question."

The same reasoning covers SEC's disinclination to assume authority to investigate utility expenditures in support of private ownership and similar issues.

Not entirely as a surprise, Purcell and Milton Cohen, director of SEC's Public Utilities Division, spent most of their time at closing hearings explaining why all of the amendments suggested by the industry in earlier testimony are so dangerous that not one may safely be enacted lest the utility industry's clock be turned back to a pre-1935 date. Without considering the validity of their arguments against the industry amendments, the Purcell-Cohen testimony against them will probably be sufficient to smear whatever hope might once have existed of amending the act at all seriously this session.

Purcell asserted that the Holding Company Act is "almost universally conceded to be exceptionally good as a work of draftsmanship," and added:

"Any imperfections which might be found, are, we believe, of a real *de minimis* nature and any attempt to deal with them at this late date is likely to cause far more harm than good."

The constitutional question invoked by Purcell against the delegation to a federal agency of jurisdiction over fees paid in public purchase of a private system should slow down if not halt any such amendment. That regarding investigation of non-political, non-operating expenditures seems pretty well within the purview of the Federal Power Commission already, judging by some of its activities and reports.

Not Much Left for Action

Thus, about the only possiblity of affirmative action by the Boren subcommittee and by the full Interstate and Foreign Commerce Committee is enactment of a resolution asking the House Ways and Means Committee to terminate the tax exemption available to securities issued to finance such transactions as that which removed the Nebraska Power Co. from private ownership on December 26, 1944.

Such a resolution, of course, would serve only to lend support to whatever elements in the Ways and Means Committee might be searching for methods of equalizing the burdens borne by public and private business. (No one should hold his breath while awaiting such equalization by any Ways and Means Committee of the last 13 years.) It would not begin to affect the principal inequity between public and private operation of electric power systems —the federal income tax—although it probably would raise somewhat the interest rate which would be required of such securities if the tax exemption were removed.

Such a resolution would be a far cry from the remedy that is needed, from what, indeed, was sought when the committee started delving into that wonderful Nebraska Power sale where control of a $45,000,000 operating company was acquired by persons who put not a nickel into it, and where the holding company, under orders to divest its interest therein, ostensibly did so by exchanging common stocks for bonds which were secured by the common stocks ordered divested.

NEWS OF THE WEEK

Northwest Association Told to Fight Socialization Trend

Speakers at Northwest Electric Light & Power Association Meeting Stress Need of Industry to Throw off Its Apathy and Publicize Menace of Public Power

AN AWAKENED CONSCIOUSNESS to the necessity of doing more and doing it quickly to combat the trend toward socializing of private power pervaded the atmosphere of the business development section meeting, Northwest Electric Light & Power Association, held in Portland, Ore., April 15-17. Kinsey M. Robinson, president, Washington Water Power Co.; Ed Dunning, vice-president, N. W. Ayer & Son, and Ashton B. Collins all in forthright manner laid the situation squarely on the line.

Robinson, who minces no words in his testimony before congressional committees, said the industry had been lax over a period of years in its fight for a 50-50 break and deplored the fact that all top executives are not in there pitching.

Ed Dunning reported progress, growth, and results of the electric companies' national advertising program. He said the campaign has contributed largely to a change of public attitude toward the industry and presented survey figures to prove the statement. But, there is a long way to go, he declared.

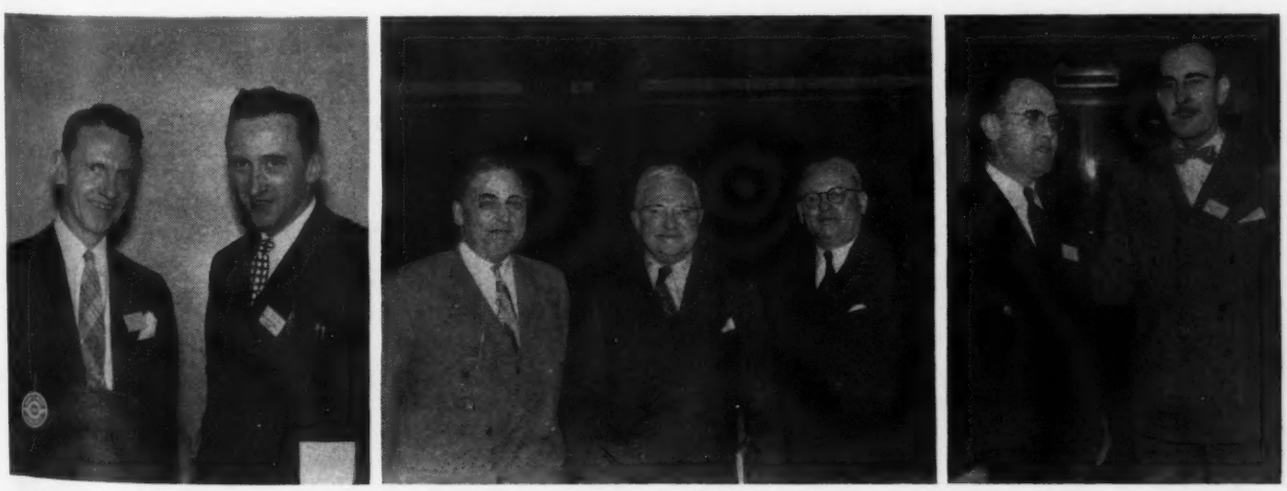
Ash Collins, Reddy Kilowatt Service, said the industry must get down to grass roots public relations if the youth of America is to get the truth about private power under free enterprise instead of being molded by the ideological theories of clever propagandists. Public relations must be streamlined and brought up-to-date by visual education methods, he said.

For the first time, manufacturers, distributors, contractors, and retailers participated fully in the program as members of the association. Representative speakers from each of these branches of the industry displayed not only a grasp of their own problems, but also a determination to make industry cooperation pay off in its fight against regimentation of every branch of the business.

A. E. Kuhnhausen, president of the newly organized Northwest Appliance Dealers Association, deplored and denounced the trend toward cooperatives and public power and pledged the fighting support of dealers in the five-way electrical industry battle to preserve free enterprise.

J. H. Polhemus, president, Portland General Electric Co., in an address opening the meeting, said he saw great opportunities for the industry to re-direct its business development effort. "It will profit us to spend less effort on refining our own product and selling it intensively in the narrow sense and to spend more effort toward increasing the extent of other peoples' ability to buy through the medium of a broadened selling program embracing the entire region and designed to expand to the fullest possible potential all the wealth-producing enterprise it now contains, as well as those that can be brought within its confines in the future," he said.

In line with this philosophy, there will be launched immediately services of the Research Advisory Service by eight members of the association. Each company will organize its own staff to carry out objectives of the service, all under the direction of Ladner Ross, on leave from Washington Water Power Co. The purpose is to place at the disposal of existing or prospective industrial plants facilities of the Research Advisory Service with its some 900 cooperating national



LEADERS IN NORTHWEST UTILITY ACTIVITIES—Left panel, Ladner V. Ross, director of the Research Advisory Service of the Northwest Electric Light & Power Association, and C. T. Bakeman, Puget Sound Power & Light Co. Center, Kinsey M. Robinson, president of the Washington Water Power Co.; Ed. Dunning, vice-president of N. W. Ayer & Son; Paul B. McKee, president of Pacific Power & Light Co. Right, Orland Mayer, Idaho Power Co.; F. M. McKay, Portland General Electric Co.

industries and laboratories in finding solutions to manufacturing, production and marketing problems.

George C. Tenney, editor of *Electrical West*, predicted large casualties among the 4,000 odd new electrical appliance dealers that have entered the field during the past year to swell the total in the eleven western states to 10,000. Few can survive long on the present stocks of samples only.

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Death of Chief Justice Stone Won't Affect Utility Cases

The death this week of Chief Justice Harlan F. Stone is not expected to have any effect on determination of four cases now before the Supreme Court involving constitutionality of the "death sentence" clause of the Public Utility Holding Company Act.

The Chief Justice died after delivering an opinion. He was 73 years old and had been on the court for 21 years, chief justice for the last five.

It was learned that the remaining Holding Company Act cases—SEC vs. Engineers Public Service; Engineers Public Service vs. SEC; American Power & Light Co. vs. SEC; and Electric Power & Light Co. vs. SEC, the latter two testing validity of SEC 11 (b) (2)—have been voted upon by the six-Justice quorum which heard them. Opinions are now being prepared. The recess until after the funeral of the late Chief Justice may delay delivery of these opinions but will not do more than that, court attaches believe.

Stone allowed the court to obtain a quorum to hear the Holding Company Act cases by removing a self-imposed disqualification last spring. The cases were argued last fall. In a recent decision on one of them, the North American case, the Court upheld constitutionality of Sec. 11 (b) (1) of the Holding Company Act, whereunder holding companies may be ordered to divest themselves of all but a single integrated system.

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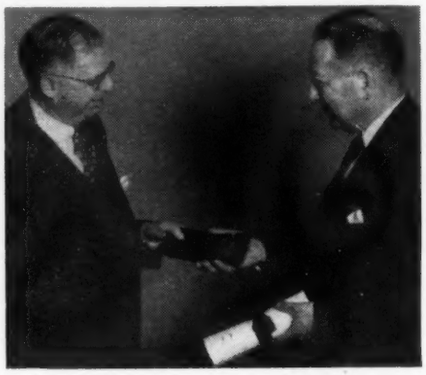
FPC Denies Jurisdiction

The Federal Power Commission has refused a rehearing of its January decision that it has no jurisdiction over affairs of the Nebraska Power Co., according to William Ritchie, attorney for ten intervenors who asked the commission to reverse its stand.

The commission originally ruled on a proposed refinancing of Nebraska Power preferred stock that it had no jurisdiction over the utility's financial affairs. The utility had asked to borrow $7,000,000 for preferred stock retirement.

1945 McGraw Wholesalers Medal Given Herbert Metz

The 1945 Wholesalers Medal, one of the James H. McGraw Awards for Electrical Men, has been awarded to Herbert Metz, assistant manager of the Metropolitan District of the Graybar Electric Co. The presentation was made Tuesday in Chicago at a meeting of the National Electrical Wholesalers Association by



Herbert Metz, left, and S. B. Williams

Samuel B. Williams, editor of ELECTRICAL WORLD and secretary of the committee of awards.

Mr. Metz received the award in recognition of his constructive contribution, as chairman of the Postwar Planning Committee of the National Electrical Wholesalers Association, to creative thinking and sound planning for the business and employment needs anticipated upon a return to a civilian economy.

An honorable mention was also made posthumously to Willard Hall, vice-president, Times Appliance Co., New York City, in recognition of his constructive contribution to post-war sales planning of electrical wholesalers through the origination, under the sponsorship of the Postwar Planning Committee of NEWA, of a basis for considering potential appliance sales that excludes conjecture and guess work, and can be a guidepost for success or failure in any appliance distribution.

The award to wholesalers was last made in 1942 to John M. Newton, president, Oakes Electrical Supply Co., Holyoke, Mass.

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Franchise Extended

Washington Water Power Co. has been granted an indefinite extension on its franchise with Spokane, Wash., pending a forthcoming election which would bring a proposal for its renewal to city voters. Continuation of the previous agreement, under which the power company pays the city 1 percent of its gross earnings at the rate of $100 per day for use of city streets, has been in effect since March 1. According to Kinsey M. Robinson, president of the company, the extension will clear the slate for a projected sewage disposal bond issue election in Spokane, where more than one special election within six months is prohibited by law.

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Western Union Will Erect Radio Beam Circuits in East

New methods of transmission to be used by Western Union, aimed toward producing a more rapid and stable system for transmission of messages, will gradually replace much of the present grounded system. Radio beam carrier circuits between the largest centers of business and extension of wire carrier-circuits for more general use are included in plans recently announced by the company's engineering department.

First step in Western Union's improvement program is a triangular radio relay network with terminals at New York, Washington and Pittsburgh. Towers placed 30 to 50 miles apart will beam the signal energy in line-of-sight channels.

More extensive use of the wire carrier circuits will reduce effects of continuous 60-cycle induction and of earth currents from magnetic storms. Installations of teleprinter equipment and a new type of repeater are expected to complete the desired stabilization of the telegraph network.

It is likely to be many years before all the grounded circuits can be eliminated. Meanwhile, the rapidity of operation by machines puts a premium on circuit accuracy and stability, the technical annoucements warn, and short circuit conditions on paralleling power systems will continue to be a problem from the standpoint of communications effect.

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Miami Lines Get Storm Protection under Program

Field work has begun on the first portion of an installation of aerial cable in Miami, Fla., and surveys have been continued looking to the extension of underground distribution facilities. The objective of the $5,000,000 expansion program of Florida Power & Light Co. is to give the city more dependable protection against a power breakdown in time of storms and more complete service under normal conditions.

Following the hurricane last autumn, the city commission attempted to force the utility to place all lines underground but gave up the attempt after Florida Power & Light testified at a hearing that the cost would be $137,000,000.

Boston Edison Co. Plans '46 Construction Program

Announcement of continuing construction activities by the Boston Edison Co. presages a busy year for its engineering and operating forces in 1946. At Mystic generating station in Everett, construction is under way for a third 50,000-kw. General Electric Co. high-pressure turbogenerator and Combustion Engineering Co. boiler scheduled for operation in 1947.

This spring it is expected that the installation of two 50,000-kva., 110/13.8-kv. transformers at Mystic for connecting the new 110-kv. Mystic-Woburn cable to system distribution facilities at this point will be completed.

It is planned that the Mystic-Woburn cable line, which will be completed this spring, will provide for power transfer from Mystic and L St. stations to the Woburn area and thence through transfer rights over New England Power Co. connecting lines to the Edgar station area in North Weymouth. This year work will continue on the acquisition of rights-of-way for the proposed 110-kv. overhead line from Woburn to Framingham, to complete the company's 110-kv. connection between Mystic and Edgar stations.

To meet increased load growths, a primary network system will be built in Somerville. The Willow Ave. substation will be retained to furnish switching facilities for the company's 13.8-kv. lines passing through the territory. Another primary network has been authorized as an extension to the Roxbury primary network system.

The company is resuming its program, interrupted by the war, of making alternating current available in territory still served by direct current. The installation of a secondary network system has been started in the downtown section of Boston which will make available alternating current service in the Park Square section, and in the central city area bounded by Tremont, Court and State, Essex Sts. and Atlantic Ave. About 5,400 kva. in static capacitors was installed on poles in 1945 and connected to 4-kv. distribution circuits in the area normally supplied by the Edgar station, to improve load power-factor and utilize additional generator and transmission capacity. In 1946 about 20,000 capacitor kva. additional will be installed to improve conditions in this area further.

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Niagara Falls Power Co. Will Pay State for Water

Niagara Falls Power Co. has agreed to pay the state of New York for the water which it diverts from the Niagara River for generating electricity.

Under the agreement, the utility will pay an annual rental of $1,100,000 for 20,000 cubic feet of water per sec. for a 12-year period beginning July 1, 1943, when the state passed a law permitting the charge for water diverted from the Niagara River by private companies.

The utility is also to pay the arrears of approximately $2,000,000 from July 1, 1943, within one month, shall not pass on the rental to its customers in increased rates, and the Water Power and Control Commission shall have the right to reexamine the reasonableness of the rental for the future on or after July 1, 1950.

The settlement follows a recent decision by Justice Francis Bergan of the State Supreme Court upholding the constitutionality of the 1943 law.

Army Awards Presented to War-time Coordinators

Officials of Utilities in Middle Atlantic and New England States Given Certificates

The Army, "to express its appreciation for patriotic service in positions of trust and responsibility," has presented certificates to utility executives who served as coordinators of the Utilities Wartime Aid Program.

At the ceremonies last week in New York, the awards were made to employees of utilities in the Second Service Command, covering most of the Middle Atlantic States.

Those receiving awards were:

Buffalo Niagara Electric Corp.—Thomas J. Brosnan, J. H. Mileyer; Public Service Electric & Gas Co., Newark, N. J., —George E. Dean, Carlton L. Dudley, Walter D. Eldridge, W. A. Guess, J. Ralph Hanford, George P. Simmen, Stanley Wilcox.

Consolidated Edison Co.—J. E. B. Stuart, James J. Kiernan; Westchester Lighting Co.—E. H. Carr; City of Dover (N. J.) Municipal Plant—George Collins; Long Island Lighting Co.—H. J. DeBaun; Atlantic City Electric Co.—William DeLong, B. L. England; Central New York Power Co.—G. B. Freer, C. M. Taylor, Clark Terry, John L. Welch.

New York State Electric & Gas Corp.—L. P. Fries, R. C. Smith, Dean W. Taylor; New York Power & Light Co.—Wesley J. Gilson; Patchogue Electric Light Co. —R. R. Hawkins; Delaware Power & Light Co.—Thomas Hooker; New Jersey Power & Light Co.—P. Powers Kinnamon.

Rochester Gas & Electric Corp.—Ivar Lundgaard; Jersey Central Power &

Corps of Engineers Photo

REWARDED BY THE ARMY—Certificates of Commendation from the War Department were presented last week in New York to this group of regional and post coordinators of the Utilities Wartime Aid Program

Light Co.—R. P. MacGalliard, John McDonnell, Wynn C. Rose; Staten Island Edison Corp.—J. H. MacNeal, Gilbert Pearsall; Lewes (Del.) Board of Public Works—C. C. Marshall; Millville Electric Light Co.—H. H. Melvin; Rockland Light & Power Co.—L. E. Merrow.

The previous week in Boston, the awards were made for the First Service Command, covering the New England States.

Those receiving awards were: Boston Edison Co—John T. Ward, Daniel Ricker, John F. Maxwell, Everett G. Stebbins, Donald H. Hathaway, St. George T. Arnold; Lynn Gas & Electric Co.—Harold E. Ayer; New England Power Co.—Kenneth W. Landry, John W. Keeney, Harry B. Stearns; New Bedford Gas & Edison Light Co.—Walton S. Fenstermacher, Frederick A. Hubbard; Provincetown Light & Power—William F. Gilman; New England Power Service Co.—Winfred D. Wilkinson, Wendell C. Phillips, Herbert E. Gfroever.

Western Massachusetts Electric Co.—Leonard J. Presson; Cape & Vineyard Electric Co.—John E. McMaster; Suburban Gas & Electric Co.—Alfred F. Gardella, Charles H. Deery; Holyoke Water Power Co.—Robert E. Barrett, Jr.; Green Mountain Power Corp.—Ralph N. Hill, Aldus S. Trobridge; Casco Bay Light & Water Co.—Herman Burgi; Central Maine Power Co.—John L. Collins, Everett H. Carr; Bangor Hydro-Electirc Co.—Robert N. Haskell, Narragansett Electric Co.—Charles P. Lazarek, Cyril R. Broadhead; Newport Electric Corp.—James J. Haggerty; New Hampshire Gas & Electric Co.—Warren H. Allen; Public Service Co. of N. H. — Avery R. Schiller.

New England Gas & Electric Association—Edward H. Steele; Central Massachusetts Electric Co.—John W. Gale; Gardner Electric Co.—William R. McKeogh; Long Island Lighting Co.—Samuel E. Bowler; Kittery Electric Light Co.—William F. Tilton; Hudson Light & Power Dept.—Thomas A. Walsh; Fishers Island Electric Corp.—Henry L. Ferguson; Houlton Water Co.—J. Norman Mullen; Maine Public Service Co.—Milton S. Blackwell; Chicopee Electric Light Dept.—Roy P. Benedict; Taunton Municipal Lighting Plant—Chester F. Buckley; Town of Hull Electric Light Dept.—Andrew F. Pope; Public Electric Light Co.—Algot W. Peterson; Hartford Electric Light Co.—John R. Donohue; United Illuminating Co.—Charles A. Williams; Connecticut Light & Power Co.—Walter P. Schwabe, Albner C. Bristol, Gerald H. Davis.

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Los Angeles 287-Kv. Line Repaired in Record Time

Ability of the Los Angeles Department of Water and Power to make emergency transmission line repairs quickly and maintain continuity of service was exemplified recently when a Navy airplane was accidently flown into two circuits of its Boulder 287-kv. lines at 10 a.m. on March 12. Middle conductor of each circuit was cut, thus interrupting the two circuits which were carrying 275,000 kw., about half the system load. A third Boulder circuit terminating in another part of Los Angeles was not damaged.

In three hours the fault was located and the one circuit was restored to service, by means of the special temporary splicing equipment designed and built by the Department's personnel. (ELECTRICAL WORLD, May 20, 1939, Page 1483, and April 4, 1942, Page 1200). The other circuit was restored shortly afterwards in time to carry the peak load expected at about 6 p.m.

Southeastern Exchange Backs Heat Pump Study

To speed the perfection of the heat pump, the Southeastern Electric Exchange, an association of electric utility companies operating in nine Southeastern states, has established a project at the Southern Research Institute. The project will include a survey of the present status of heat pump development plans of manufacturers for its future, activities of utility companies in this field and their plans for promoting its use, compilation of such practical and theoretical information as might be necessary for evaluating the practicability and possibilities of the heat pump especially for operation in the Southeastern states, and finally such experimental work as might be necessary to provide actual performance data to supplement opinions, calculations, and information obtained from the literature, from direct interview, and from the performance of current installations.

Dr. E. N. Kemler, head of the Institute's Engineering Research Division, will direct the project.

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Foreigners Didn't Pay Tax So Canadian Utility Must

Under a recent order of the Supreme Court of Canada, The British Columbia Electric Railway Co. must pay a 5 percent income tax plus 10 percent interest on 16 dividends, totalling $2,708,682, paid non-resident holders of its 5 percent cumulative perpetual preference stock between 1933 and 1941. The court, in reversing a lower court, ruled that the utility should have withheld the tax from dividends paid foreign stockholders.

FIRST SALES CONFERENCE—Members of the Industrial Sales Committee of the Pennsylvania Electric Association at their first post-war sales conference held April 11 and 12 at Hershey, Pa.

Power Policy of Bureau of Reclamation Explained

A definition of the Bureau of Reclamation's power policy was given recently in Salt Lake City, Utah, before a meeting of the Bureau's Region IV personnel by H. F. McPhail, director, branch of power utilization for the eleven western states.

He explained that the Bureau was not fundamentally organized to produce electricity, but that irrigation projects whose costs were low enough to allow financing by sale of water are all built; that the 415 future projects mapped by the Bureau are mostly in the higher cost brackets and the sale of power will provide about 75 percent of their financing.

The Bureau is required by law, Mr. McPhail pointed out, to give preference to public agencies, such as municipalities and cooperatives, in the sale of public-owned power—but not to put private operations out of business. The Bureau is a wholesaler only, he explained.

When private enterprise in a locality can and will make power available as cheaply as the government can, the private utility should stay in business, Mr. McPhail said.

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Maryland Utilities Group Elects Gas Man President

Otis H. Ritenour, comptroller, Washington Gas Light Co., was elected president of the Maryland Utilities Association at its recent spring meeting.

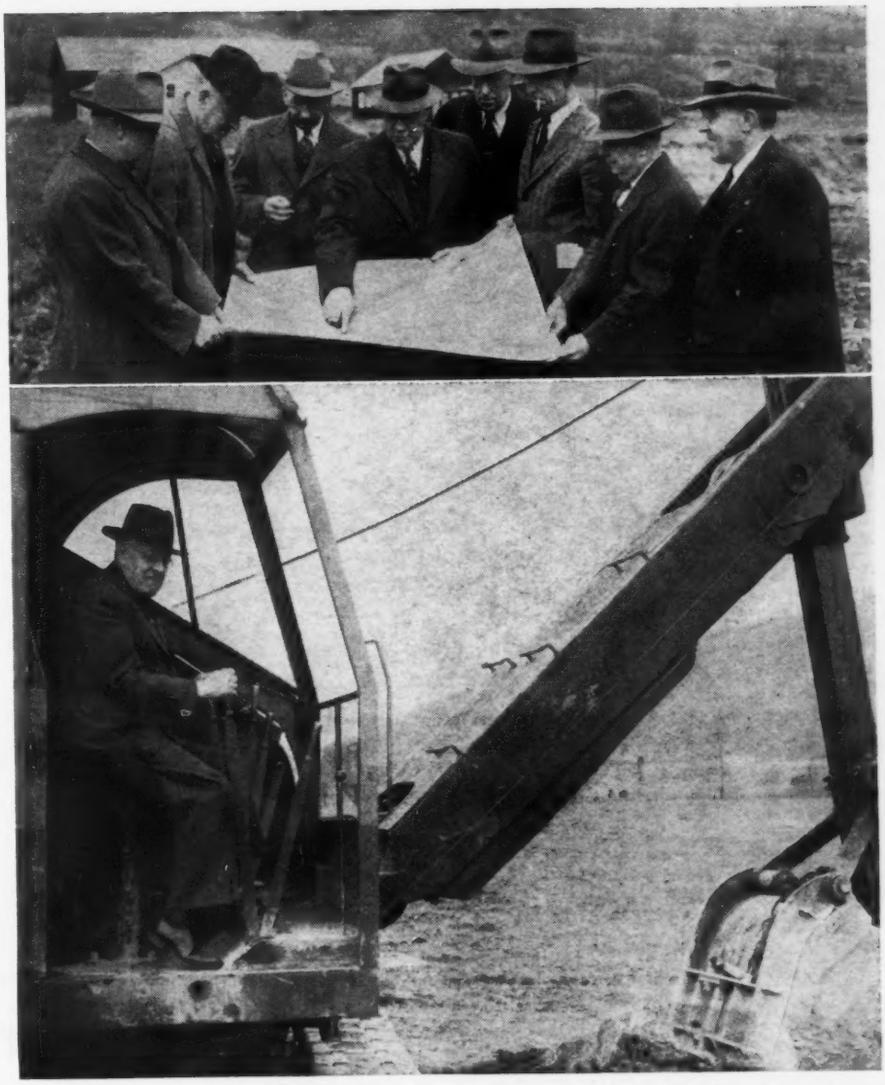
Other officers elected are Charles P. Crane, executive vice-president, Consolidated Gas, Electric Light & Power Co. of Baltimore, vice-president; J. Carl Fisher, manager of general service of the same utility, treasurer; and Raymond C. Brehaut, manager of suburban companies affiliated with Washington Gas Light Co., secretary.

Among the seven directors are these electric utility men: Henry S. Davis, general manager, Conowingo Power Co., Harold G. Haydon, comptroller, Potomac Electric Power Co.; Lewis Payne, president Eastern Shore Public Service Co.; and D. Edward Stultz, vice-president, the Potomac Edison Co.

[redacted]

Commission Will Move

Head offices of the New Brunswick Electric Power Commission, which have been at St. John since the commission was founded in 1920, are to be moved to Fredericton when a new building is completed there in 1946. The commission decided that Fredericton, the provincial capital, is a more central location.



STARTING PENELEC'S NEW PLANT—Officials of the Pennsylvania Electric Co., top panel, inspect plans for the company's new 30,000-kw. steam plant along the Allegheny River west of Warren, Pa., before President P. H. Harris, lower panel, takes the controls of a steam shovel to break ground. The officials, left to right, are Vice-President W. C. Sontum, President Harris, M. J. Fulton, engineering superintendent; S. J. Mayhew, production engineer; M. J. McCleary, assistant to Mr. Sontum; J. P. Fenstermacher, Warren district manager; H. A. Wallace, supervisor of plant construction; and E. E. O'Brien, construction superintendent of Gilbert Associates

Dolbeare Picked by Vepco to Head New Department

Walter Dolbeare has been named di- [redacted]ginia Electric & Power Co's [redacted]development department. [redacted]ho has just returned after [redacted]with the Navy where he served as a commander, has been with the utility since 1927. In that time, he has been an illuminating engineer, assistant to the president, manager of the Williamsburg and Suffolk districts, in addition to holding several other positions.

The new department will cooperate with planning boards, chambers of commerce, railroads, and other groups now planning further industrial and economic development in the Vepco territory. Mr. Dolbeare's office will be at Richmond.

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Duquesne Wages Settled

The Independent Association of Employees of the Duquesne Light Co. and Associated Companies has accepted an arbitrator's award of 18 cents an hour general wage increase. George L. Mueller, president of the union, expressed dissatisfaction with the award and indicated that the union will seek higher wages on July 1 when negotiations may be reopened.

Foreign Governments Get Export-Import Bank Loans

Money Is to Be Used for Purchase of Electrical Equipment from Firms in the United States

Loans totalling $27,350,000 for the purchase of U.S. electrical equipment have been granted four Latin American governments or companies, the Export-Import Bank has reported to Congress.

Largest of these loans was a $20,000,000 credit to Mexico "to assist in financing the purchase in the United States of equipment, materials, and services to be used in connection with a broad electrification program in Mexico." The program is to be carried out by the Comision Federal de Electricidad, which is an agency of the government, in cooperation with the Nacional Financeria, a quasi-governmental agency.

The credit may be used at any time before June 30, 1948, and repayment will be made in 40 semiannual installments approximately equal. Interest will be 4 percent yearly. Advances will be secured by assignment of revenues from specified taxes on Mexican energy consumption and by unconditional guaranty of the Mexican government.

An advance of $5,000,000 was made to the Chilean Development Corporation, of which $2,000,000 is for purchase in the United States of equipment for additional hydroelectric facilities. The remaining $3,000,000 is for projects as yet undetermined. It will be repayable in 5 years at 4 percent.

The Chilean State Railways were granted a $2,000,000 credit for purchase of electrical equipment, the loans to be repayable in 7 years at 4 percent.

The smallest loan was a $350,000 credit to the Peruvian Companian del Santa. It was extended on the application of a U.S. supplier of electrical equipment, and is repayable in 10 years at not less than 4 percent.

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Utility Reports Simplified

An order to electric utilities in Arizona was recently handed down by the state corporation commission requiring submission of subsequent reports on new streamlined forms. Reports have been submitted on obsolete forms dating back to 1923. Commissioner W. J. Eden, who initiated the change, said it would aid materially in obtaining essential information about utility financial affairs and operations, and in addition would reduce the amount of work now imposed on the utility companies. Type to be used will be similar to that by which the firms make their reports to the Federal Power Commission. A supplemental questionnaire also will be drawn up for eliciting additional information the commission needs concerning electric company operations.

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Record Hydro Production for 1945 Reported by FPC

Electric utility generating plants produced a total of 222.4 billion kw.-hr. for public use during 1945, a decline of 5.8 billion kw.-hr. or 2.5 percent from the record production of 228.2 billion kw.-hr. in 1944, according to a report issued by the Federal Power Commission.

While marking the first decline in annual output since 1938, the 222.4 billion kw.-hr. 1945 total exceeded the 1940 production by some 80 billion kw.-hr., or more than 55 percent.

As the result of unusually favorable water conditions, production by hydroelectric plants established a record of 79.9 billion kw.-hr. during the year. Output of hydro plants accounted for 35.9 percent of the total from all sources.

The report showed that installed capacity of utility generating plants totaled 50,102,442 kw. as of December 31, 1945, indicating a net increase of about 913,000 kw., or 1.9 percent over the corresponding 1944 total.

Home Service Department Guide Published by E.E.I.

A comprehensive guide for the electric utility company which has or is considering organizing a home service department has been prepared by the Home Service Committee of the Commercial Division General Committee, Edison Electric Institute.

Entitled "Suggestions for Organizing and Operating Home Service Departments of Electric Companies," the booklet covers such topics as the reasons for a home service department, how both utility and customer benefit by its activities, suggested activities, suggestions on the selection and assignments of personnel, training requirements of personnel and records and reports needed by management.

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Connecticut Seeking Engineer

Because of the fewness of candidates for the position of chief utilities engineer with the Connecticut Public Utilities Commission, the requirement of state residence has been waived; and the final date for filing applications has been extended to May 10. The position pays between $5,520 and $6,720 a year, and further information can be secured from the P.U.C. office at Hartford.

MEETINGS

Southeastern Electric Exchange—Residential and home service conference, Atlanta Biltmore Hotel, Atlanta, Ga., May 14-15. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta, Ga.

Pacific Coast Electrical Association—Annual convention, Fairmont Hotel, San Francisco, Calif., June 12-14. V. W. Hartley, managing director, 447 Sutter St., San Francisco 8, Calif.

Previously Listed

International Lighting Exposition—Stevens Hotel, Chicago, Ill., April 25-30. A. B. Coffman, manager, 111 W. Jackson Bldg., Chicago 54, Ill.

Edison Electric Institute—Engineering committees, Edgewater Beach Hotel, Chicago, Ill., May 6-7; annual convention, Waldorf Astoria Hotel, New York, N. Y., June 3-5. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

National Association of Corrosion Engineers—Annual convention, President Hotel, Kansas City, Mo., May 7-9. Elton Sterrett, executive secretary, 318 Southern Standard Bldg., Houston 2, Texas.

Arkansas Utilities Association—Annual convention, Arlington Hotel, Hot Springs, Ark., May 13-14. R. E. Ritchie, secretary, Arkansas Power & Light Co., Little Rock, Ark.

Pennsylvania Electric Association—Commercial committee, New Castle, Pa., May 23; A. G. Garrigues, chairman, Philadelphia Electric Co., Philadelphia, Pa. Rural committee, State College, Pa., May 23-24; W. H. Ferguson, chairman, Duquesne Light Co., Pittsburgh, Pa. Engineering Section, all committees, Penn Harris Hotel, Harrisburg, Pa., May 28-29; E. B. Shew, chairman, Philadelphia Electric Co., 900 Sansom St., Philadelphia, Pa.

Southeastern Electric Exchange—Spring power sales conference, Battery Park Hotel, Asheville, N. C., May 23-24. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta, Ga.

Great Lakes Power Club—Spring meeting, Palmer House, Chicago, Ill., May 24. Almer Skretting, secretary-treasurer, Wisconsin Electric Power Co., Milwaukee 1, Wis.

National Fire Protection Association—Annual meeting, Hotel Statler, Boston Mass., week of June 3. R. S. Moulton, technical secretary, 60 Batterymarch St., Boston 10, Mass.

National Electrical Manufacturers Association—Special sections meetings, The Homestead, Hot Springs, Va., June 17-19. W. J. Donald, managing director, 155 E. 44th St., New York 17, N. Y.

American Society of Mechanical Engineers—Semi-annual meeting, Book Cadillac and Statler hotels, Detroit, Mich., June 17-20. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York 18, N. Y.

American Society of Agricultural Engineers—Annual meeting, New Jefferson Hotel, St. Louis, Mo., June 24-26. Raymond Olney, secretary, St. Joseph, Mich.

American Institute of Electrical Engineers—Summer convention, Hotel Statler, Detroit, Mich., June 24-28. H. H. Henline, secretary, 33 W. 39th St., New York 18, N. Y.

American Society for Testing Materials—Annual meeting, Buffalo, N. Y., June 24-29. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia 2, Pa.

Canadian Electrical Association—Annual meeting, Banff Springs Hotel, Banff, Alberta, Canada, June 26-28. B. C. Fairchild, managing director, 704 Tramways Bldg., Montreal 1, Que., Canada.

Unfriendliness Enters Suit over Utility Sale to P.U.D.

The "friendly" suit instigated by Washington's Skagit County P.U.D. to test the legality of its $135,000,000 bond issue for purchase of Puget Sound Power & Light properties (ELECTRICAL WORLD, April 6, page 5) turned out last week to be anything but "friendly," with attorneys representing many factions pecking away at the many legal issues involved.

Besides the two main litigants, Superior Court Judge W. L. Brickey has allowed "friends of the court" and intervenors to join in the suit, notable among them the corporation counsel for the City of Seattle, State Attorney-General Smith Troy, and the Weyerhaeuser Lumber Co. Weyerhaeuser entered the case as having large holdings in western Washington, and as objectors to P.S.P. & L. properties being taken from the tax rolls.

Witnesses included bankers, P.S.P. & L. executives; R. W. Beck, consulting engineer for the P.U.D.'s; Charles F. Fricke, Columbus, Neb., drug store operator and former head of the Nebraska Consumers Public Power District; and various P.U.D. officials.

After three days of testimony given in the Mount Vernon Court, the opponents of the deal called for and won on April 19 a continuance of the hearing until April 26.

Many phases of the complex transaction drew fire from attorneys during the three days, with some 24 legal points being tested. More than once tempers flared, and the court was forced to step in to quiet the proceedings.

Regardless of the outcome of the present hearing, Attorney-General Troy said he will take the case to the State Supreme Court.

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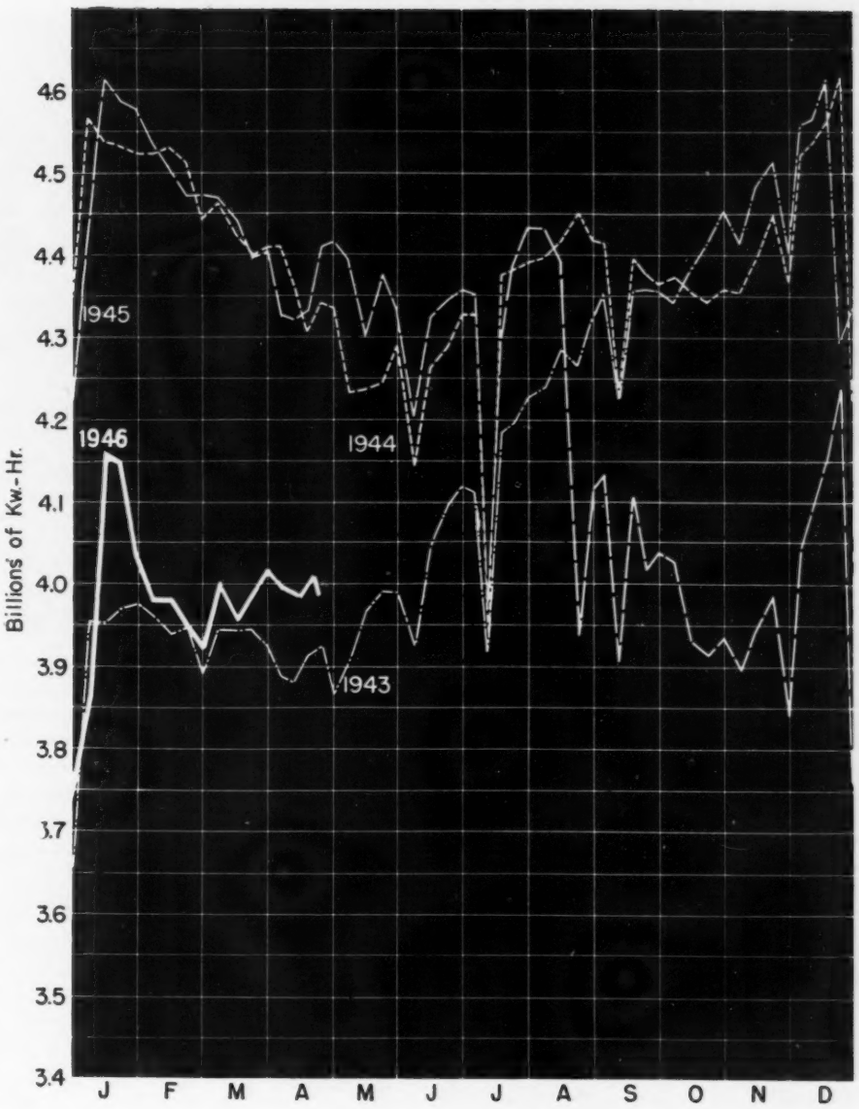
Public Service of Indiana to Build 50,000-Kw. Plant

Construction of a new 50,000-kw. steam electric generating station on the White River near Noblesville, Ind., is currently under consideration by the Public Service Co. of Indiana, it was disclosed recently in Indianapolis.

Tentative plans indicate that the initial installation will consist of a 50,000-kw. turbine and two pulverized fuel fired boilers and that the installation will be placed in service in 1950. It is presumed that construction of the plant, which may cost an estimated $5,000,000, will get under way in 1947.

The decisions as to details of design including operating steam pressure and temperature and capacity have not yet been made.



Electric Output Curve Turns Downward

The electric output curve moved slightly downward during the week ended April 20, 1946, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry totaled 3,987,145,000 kw.-hr., compared with 4,014,652,000 kw.-hr. during the preceding week. During the week ended April 21, 1945, the amount of electrical energy distributed amounted to 4,411,325,000 kw.-hr., this year's figure representing a decrease of 9.6 percent.

The seven major geographical regions reported losses for the week ended April 20 as compared with the corresponding week of last year. All regions showed increased losses as compared with the losses reported for the week ended April 13, with the exception of the Pacific Coast group. The Rocky Mountain States showed a drop of 14.1 percent; for the preceding week the decrease was only 4.8 percent.

Weekly Output, Millions Kw.-Hr.

1946		1945		1944	
Apr. 20	3,987	Apr. 21	4,411	Apr. 22	4,344
Apr. 13	4,015	Apr. 14	4,332	Apr. 15	4,307
Apr. 6	3,988	Apr. 7	4,322	Apr. 8	4,361
Mar. 30	3,992	Mar. 31	4,329	Apr. 1	4,409
Mar. 23	4,017	Mar. 24	4,402	Mar. 25	4,409
Mar. 16	3,988	Mar. 17	4,398	Mar. 18	4,400
Mar. 9	3,953	Mar. 10	4,446	Mar. 11	4,426
Mar. 2	4,000	Mar. 3	4,472	Mar. 4	4,465
Feb. 23	3,923	Feb. 24	4,474	Feb. 26	4,445
Feb. 16	3,949	Feb. 17	4,472	Feb. 19	4,512
Feb. 9	3,983	Feb. 10	4,505	Feb. 12	4,533
Feb. 2	3,983	Feb. 3	4,539	Feb. 5	4,524

Percent Change from Previous Year

	Week Ending		
	Apr. 20	Apr. 13	Apr. 6
New England	— 2.3	+ 0.1	— 1.0
Mid-Atlantic	— 3.0	+ 0.5	— 0.2
Central Industrial	—11.0	— 8.8	—11.6
West Central	— 4.1	— 0.5	— 2.5
Southern States	—12.3	—10.8	— 9.4
Rocky Mountain	—14.1	— 4.8	+ 4.7
Pacific Coast	—12.6	—12.9	—12.2
Total United States	— 9.6	— 7.3	— 7.7

SEC RULINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

NORTH WEST UTILITIES CO. investment of not in excess of $1,500,000 as paid-in surplus of Wisconsin Power & Light Co., a subsidiary, has been approved. The funds are part of the proceeds from the sale by North West of its interests in Northwestern Public Service Co. remaining after the payment by North West of its note indebtedness of $1,000,000 to the First National Bank of Chicago. (Release No. 6531).

PUBLIC SERVICE CO. OF INDIANA proposal to sell at competitive bidding 150,000 shares of cumulative preferred, the exchange or redemption of its outstanding 148,185.9 shares of 5 percent cumulative preferred, Series A, and the solicitation of such exchanges, has been approved. The commission reserved jurisdiction with respect to the dividend rate on the new preferred, which is to be named by the successful bidder, the price to be paid for the stock and the underwriters' compensation. The company previously had offered the 150,000 shares of new preferred for sale at competitive bidding, but no bid was accepted. As the company planned to reoffer the stock when market conditions were more favorable, the commission has successively extended to May 15, 1946, the date on which the company could sell the preferred stock and retire its outstanding preferred. (Release No. 6530).

CITIZENS UTILITIES CO. has ceased to be a holding company, SEC has ruled, and its registration as such is no longer in effect. In approving the application, the commission found that the record showed that through divestment of various properties from 1935 to 1945, Citizens' business is now limited to that of an electric utility company and of a gas utility company, and to the operation of telephone and water properties through its subsidiary, Public Utilities California Corp., and of a cold storage plant, dock and wharf in Ketchikan, through another subsidiary, Ketchikan Cold Storage Co. (Release No. 6535).

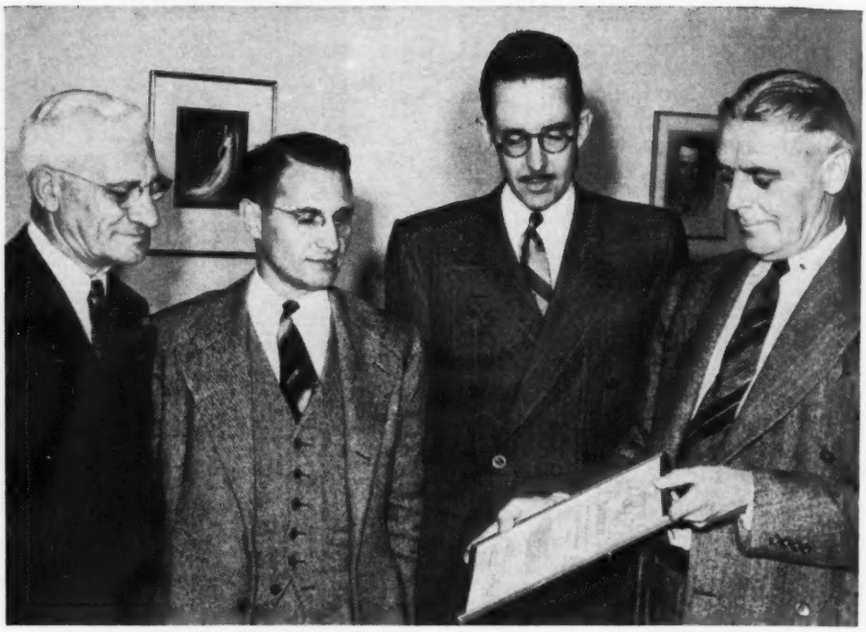
INTERSTATE POWER CO.'s application for authority to sell certain utility assets in and adjacent to Waseca, Minn., to the Peoples Natural Gas Co. because "competitive conditions were not maintained" has been denied. (Release No. 6516).

BUFFALO NIAGARA ELECTRIC CORP.'s proposal to discharge its $1,000,000 note, dated November 1, 1945, by payment to its holder, Niagara Hudson Power Corp., of principal amount, plus accrued interest at the rate of 2 percent annually, has been approved. The note is payable on or before February 1, 1952. (Release No. 6553).

GENERAL GAS & ELECTRIC CORP.'s proposed acquisition of 3,461 shares of new common stock of Tide Water Power Co., 1,870 shares of common stock of Atlantic Utility Service Corp., owned by Tide Water, and an assignment of any claims which Tide Water may have against General Gas or its parent and affiliates, has been approved. (Release No. 6561).

ST. JOSEPH LIGHT & POWER CO.'s refunding and refinancing program has been cleared. The company will sell at competitive bidding $3,750,000 of new first mortgage bonds and use the proceeds to redeem $3,635,000 of its 4½ percent first mortgage bonds at the redemption price of $100 and for construction purposes. St. Joseph is a subsidiary of Continental Gas & Electric Corp. (Release No. 6549).

STANDARD GAS & ELECTRIC CO.'s sale of its entire investment in Empresa de Servicios Publicos de los Estados Mexicanos, S. A., a Mexican corporation, to Theodore E. Sheppard for $858,000 has been approved. The investment includes 50,000 shares of $100 par value capital stock and a $428,495 claim for indebtedness. (Release No. 6557).



HONOR FOR SAN DIEGO GAS & ELECTRIC—E. D. Sherwin, vice-president of the San Diego Gas & Electric Co., displays the certificate which the utility received from the War Department for "insuring an uninterrupted supply of electricity to military installations" and furnishing "technical advice to military personnel." The spectators are, left to right, G. H. P. Dellmann, commercial sales engineer; G. E. Jenner, engineer in charge of the transmission, distribution, and design division; and J. F. Sinnott, protection engineer

UTILITY REPORTS

	Net Income 1946	1945
*Carolina Power & Light.....	$2,745,828	$2,378,888
*Central Maine Power.....	3,218,538	3,178,528
*Central Vermont Pub. Serv..	793,903	709,051
*Connecticut Light & Power..	4,510,627	4,100,056
*Idaho Power	1,286,524	1,129,317
‡Louisiana Power & Light....	1,195,528	1,111,709
‡Mississippi Power & Light...	1,147,017	1,427,063
‡Montana Power	3,938,468	4,205,258
*Public Service of New Hampshire	2,006,703	1,882,802
*Texas Electric Service.....	3,094,712	1,837,420
†Utah Power & Light and sub.	2,055,417	1,821,001

*Twelve months ended March 31.
†Twelve months ended February 28.
‡Twelve months ended January 31.

Greater G. E. Production Than in 1940 Predicted

Twice as many fractional horsepower motors and two and a half times as many fluorescent lamp ballasts as in 1940 is the expected production in 1946 of these two important items by the General Electric Co., according to Robert S. Peare, vice-president, in a paper to the Edison Electric Institute, commercial division, meeting recently in Chicago.

The shipping rate for large turbine generators, he said, is expected in 1947 to exceed the 1940 output by more than 50 percent. For the remainder of 1946 output of switchgear will go 85 percent above all of 1940. In 1946 shipments are planned to be over 200 percent of 1940. In distribution transformers shipments in 1946 are expected nearly to double 1940. And in power transformers 1946 is expected to be 145 percent of 1940 and in 1947, 160 percent. Output of meters and instruments in 1946, despite recent interruptions and difficulties, is expected substantially to exceed 1940 and to be double the rate of that year in 1947.

As to appliances, no definite figures are available, yet it can be said, as regards General Electric production, that the strike prevented production of 192,000 irons, 67,000 refrigerators and 18,000 washers. The pick-up of production will be fast, however, and probably before one realizes it retail outlets will be filled.

HOW

DESIGN • CONSTRUCT • OPERATE • MAINTAIN

Polarm Structure Applied To Dead-Ends and Angle Turns

C. A. BOOKER,

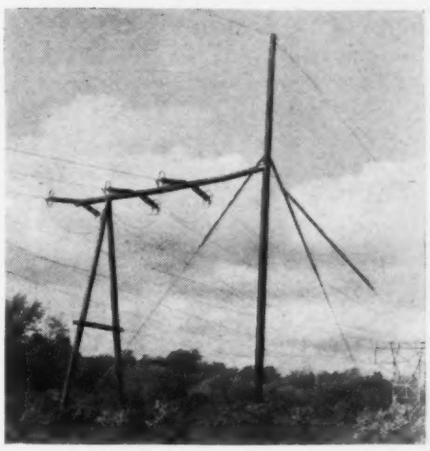
Transmission Line Engineer, New England Power Service Co., Boston, Mass.

New England Power System's "Polarm" design of transmission structure has been effectively utilized in the Massachusetts section of a new 110-kv. line interconnecting Tewksbury and Nashua, Public Service Co. of New Hampshire having built a new substation at the latter point to handle energy received at that load center. The structure illustrated typifies a design for dead-ends and angles up to 30 deg., the A-frame being used to eliminate the necessity of longitudinal guys on the shorter so-called power pole, thus maintaining the desired high wood insulating characteristics.

The structure shown is located at a 22-deg. angle in the line. Three 4/0 AWG bare HD stranded copper conductors are spaced 12 and 10 ft. apart respectively, with 12-ft. 10-in. horizontal and 15-ft. vertical spacing between the nearest phase wire and a ⅜-in. galvanized steel aerial ground wire used. Suspension structures are insulated with eight and dead-ends with nine 10-in. discs, arcing rings being provided at the live end. The aerial ground wire is grounded at each structure with a flying tap attached 15 ft. out in the span and carried to a point 15 ft. below the crossarm, and thence down the taller pole to a coil at its butt.

The normal suspension structure on this type of line consists of one 45-ft. Class 3 power pole, one 60-ft. Class 4 ground wire pole and one 35-ft. Class 3 crossarm pole, which supports the insulators 38.5 ft. above ground. Both poles are set 6.5 ft. deep in ordinary soil. The A-frame, made from two Class 3 45-ft. poles, is used only at dead-ends, angles, or special crossings, and is anchored against uplift by a 4.5-ft. square timber grillage. All angle guys are attached to the ground pole and insulated with 18-ft. long double wood sticks of special design when structural requirements necessitate their attachment to the section of pole bridged by the flying tap.

The Massachusetts section of the tie line is owned by the New England Power Co., and is constructed as above described between the system's two 220-kv. tower lines which run from Comerford station to Tewksbury. The New Hampshire portion of the tie line is owned by Public Service of N. H. In order to speed up material procurement and field construction work under war-time conditions it was agreed that each company would use its own standard type of construction for this voltage. Consequently the New Hampshire section consists of standard H-frame wood arm construction with two ground wires.



TYPICAL dead-end, angle turn in Massachusetts section of 110-kv. tie line between New England Power and Public Service of New Hampshire Systems

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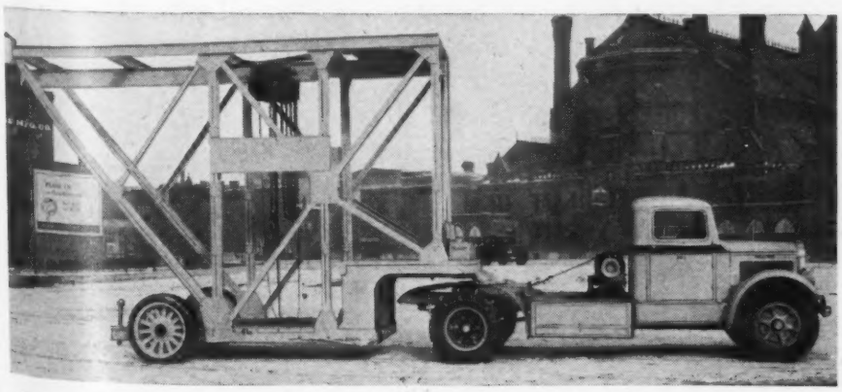


TRAILER AND TRACTOR—Trailer for transporting and lowering network transformer is 21 ft. 6 in. long, over-all. Its superstructure rises 12 ft. 8 in. above the bed which is 5 ft. 10 in. wide. Chain hoist which runs along the monorail, has capacity of 5 tons; length of chain is 22 ft.

Trailer for Handling Network Transformers

NORMAN J. BUKEY
Underground Department
Cincinnati Gas & Electric Co.
Cincinnati, Ohio

Large a.c. network transformers on the Cincinnati system are carried to the job and lowered into their vaults with the special trailer unit shown. With the trailer backed over the vault, as shown, the transformer can be lowered into place in a few minutes and with a minimum of inconvenience to both pedestrian and vehicular traffic.

Handling of transformers is done with 5-ton, hand-operated chain hoist that travels along a 21-ft. 6-in. monorail track extending the length of the trailer. Thus the transformer can be picked up in the storage yard, moved inboard and set on the floor of the trailer for transportation to the job. On location it is again lifted, run out to the end of the monorail and lowered into the vault.

Hoist chains have a length of 22 ft. but transformers can be lowered to greater depths with special slings. Height of the trailer superstructure above its bed is 12 ft. 8 in. Width of the bed is 5 ft. 10 in.

Originally designed by George Hausman, engineer in the overhead department of the company, to be towed by a Fordson-type tractor, the trailer was subsequently modified for use with a standard truck-type tractor. Its total weight is 12,000 lb. including several hundred pounds of lead in the extreme front end to counterbalance loads at the rear end of the vehicle.

TRAILER IN ACTION—Backed over the vault this special trailer is shown lowering a 5-ton network transformer into place. Trailer also transports the transformer to the job

Bath Developed For Bright Galvanizing

A five-ingredient bath to be used for the bright galvanizing of iron objects, is described in a report from Europe, by R. I. Kaufmann, recently made available through "Chemical Abstracts" (39:4287, 1945), according to *Glycerine Facts*. Each liter of the bath is stated to contain:

Zinc oxide	35.0 g.
Sodium cyanide	100.0 g.
Sodium hydroxide	100.0 g.
Sodium sulfide	0.5 g.
Glycerine	5.0 g.

A dense, shiny zinc coat is obtained in this bath at room temperature, using a current density of 7 amp. per square decimeter. The coating is made still brighter by subsequent dips in 4 percent nitric acid and 18 percent chromic acid solution.

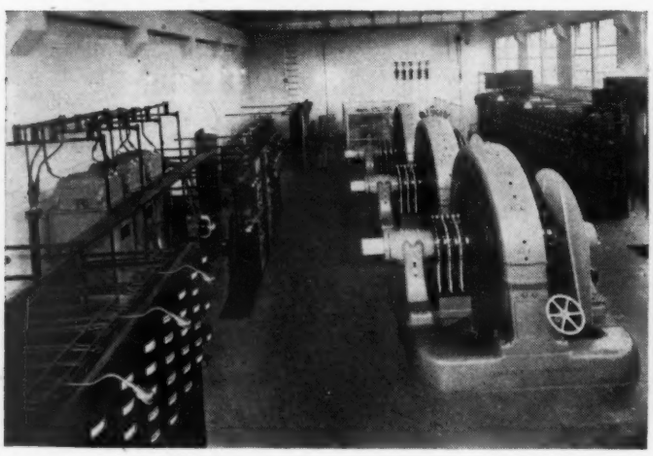
• • •

Safety-With-Paint Scientifically Planned

Substation interiors of Portland General Electric Co. are acquiring a new dress of eight different colors as part of a scientifically planned dynamic painting project designed to emphasize safety features in the stations. The project is being carried out under the supervision of C. J. Scoville, general foreman of the company, and T. W. Lowry, safety engineer.

In each substation, danger areas and important controls are highlighted and emphasized by the use of contrasting colors, which are at the same time carefully chosen and blended to furnish a light-improved and attractive decorative scheme. The ceilings are done with white or "cascade blue" for greater reflection of light. Upper walls are done in "sea foam" green and the lower parts a darker "eye rest" green.

A group of colors was carefully selected for the operating equipment with the safety factor in mind and include green, beige, yellow, orange and black. The machinery bodies are painted "vista green" which is dark enough to furnish a good background



SCIENTIFICALLY selected and applied paints in eight colors are applied to substation interiors, machines, cranes and elsewhere to emphasize danger areas and important machinery and electrical controls. The work is part of a safety-with-paint program that will include all substations and generating plants of Portland General Electric Co. Monotone photographs do not do justice to results achieved but do serve to show high-lighting and contrasts obtained

for the other lighter colors. "Focal beige" was chosen for the important job of high-lighting the projecting and moving parts and shows up well against the dark green background of the machine bodies. Step plates on the machines are painted "focal orange" for the convenience and safety of station operators while checking the machines in operation. Against the very light ceiling the "focal yellow" overhead cranes are easily discernible and their movements can be readily followed by workmen below. Black is used for such specific items as hand rails, conductors, controllers, conduit and switching equipment.

Photographs of the substations fail to show the effect of the colors but do show the generally neat appearance given by the paint job. The new safety paint dress already has been applied to PGE's Jefferson substation located in downtown Portland, and similar treatment will be given the company's other substations and generating plants.

• • •

Push Button Control for Meter Test Table

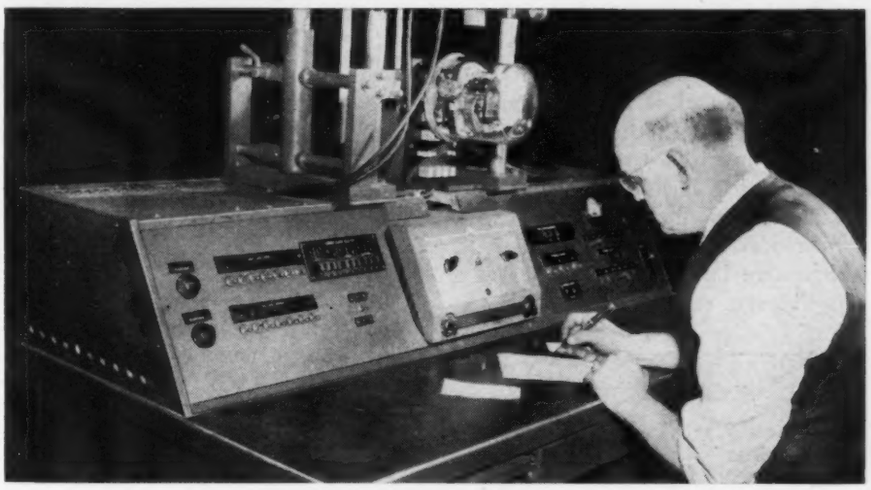
By J. L. HALEY
Supt. Electric Meter Dept.
Memphis Light Gas & Water Division
Memphis, Tenn.

The usual elaborate array of knife switches to be found on most meter test benches is completely missing from the three-phase meter test bench at the meter shop of the Memphis Light Gas & Water Division. In their places are a few push buttons and toggle switches which perform all the necessary switching operations through relays.

This semi-automatic push button control system, which is supplemented by a conventional photoelectric meter testing equipment, is the result of a studied attempt to attain polyphase test facilities that will combine maximum efficiency, accuracy and simplicity, making the tester's job easier and simplifying the training of new testers.

Used almost exclusively for testing three-phase meters, this bench can, however, test any meter, single or three-phase. It is provided with socket clips that will accept any socket meter and a plug-in adapter that permits testing of "A" type meters also.

The push button control feature of this test bench was built into an existing test table and utilizes the loading transformer, potential transformer, regulator and load selector switches of the original set-up. The original 0-100% power factor step-type phase-shifting transformer was discarded in favor of a push-button relay selector that permits selection of 0, 50, or 100 percent power factor.



PUSH-BUTTON TEST BENCH—Thirteen push buttons and a few toggle-type current selector switches that actuate switching relays in current, potential and power factor circuits has reduced three-phase meter testing with this bench to simple terms. Single-phase meters likewise can be tested

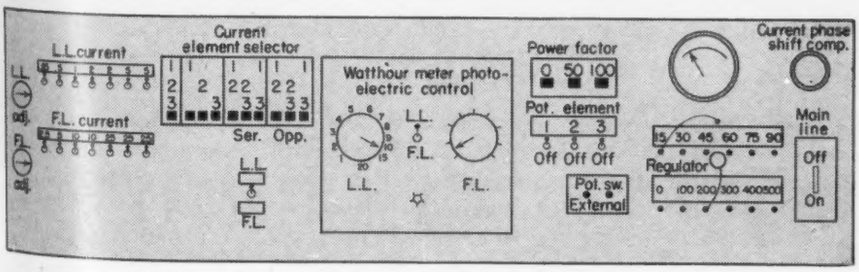
Selection of the various current elements of the meter and their arrangement in various combinations is also accomplished by a row of ten push buttons which perform the following functions:

1. Connect all three elements in series; 1-2-3.
2. Select any individual current element; 1, 2 or 3.
3. Connect any two meter elements in series; 1-2, 2-3 or 1-3.
4. Connect any two elements in opposition; 1-2, 2-3, or 1-3.

Light and full load current selector switches of the toggle type, provided on the original test bench, are used to load the various current elements. Three other toggle switches cut the three meter potential coils "on" and "off."

Push buttons and toggle switches on the face of the bench perform their switching functions through relays which operate the necessary current and potential switches in the rear of the bench. Three-pole, double-throw relays with 50-amp. contacts, for example, are used in the current circuits; double-pole single-throw relays (600 volt) in potential circuits. Power factor selector relays are double-pole double-throw and work on the 120-volt input side of the phase-shift transformers.

While it is difficult to evaluate specifically the advantages that have accrued from use of this board it is possible to say that its use, based on a year's experience, has been entirely satisfactory; that it has contributed substantially to the achievement of greater testing speed by freeing the tester from the burden of flipping switches in certain combinations.



TEST PANEL—Facsimile of the face of the push button meter test panel

Mobile Pumper for Washing Insulators

The washing of energized high-tension insulators on overhead lines and in substations has been considerably simplified on the system of the Public Service Co. of Northern Illinois by special self-contained pumping units that can be installed and operated from any stake-body truck in the field independent of normal water supplies.

The units, of which three have been built, consist of a gasoline engine-driven centrifugal pump, 1,200-gal. water storage tank, and one-man turret nozzle mounted on a special platform. Accompanying illustrations show one of the units in actual operation.

Specifications for the pumping units, which were built by W. S. Darley & Co., Chicago, are listed below.

SPECIFICATIONS

Pump: Centrifugal; capacity 500 gpm. at 120 psi. or 250 gpm. at 200 psi. or 170 gpm. at 250 psi. Lifts or drafts water 20 ft. Direct driven from gasoline engine. Automatic vacuum primer.

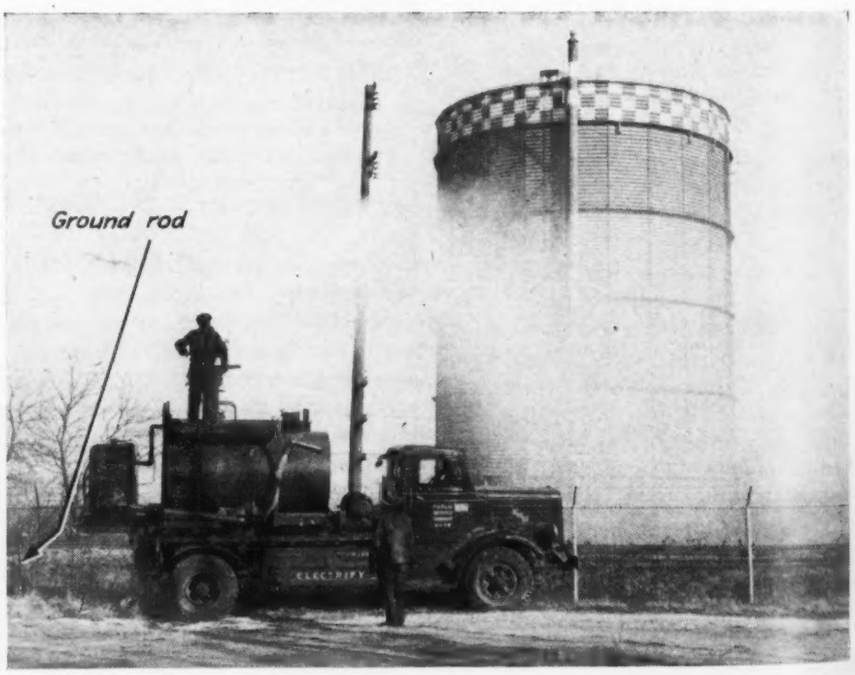
Engine: Automotive-type, six-cylinder, 100-hp. gasoline engine direct connected to pump. Supplied with self starter, battery, generator. Instruments include oil pressure gage, heat indicator, ammeter, ignition lock etc. Gas tank capacity 17 gal.

Water Tank: Capacity 1,200 gal., rust-resistant copper bearing steel; welded construction, equipped with baffle plates and manhole filter. Permanent 3-in. pipe line from tank to pump suction serves as feeder line to pump and for backfilling tank from hydrant.

Nozzle: Turret type with stream straightener in nozzle. Operated by one man from special platform. Nozzle can be adjusted up or down and around complete circle during operation. Quick action quarter-turn shutoff on nozzle and motor throttle control give operator complete control of water volume and pressure from platform. Permanent 2-in. pipe line from quarter-turn discharge valve on pump to nozzzle. Pressure gage on pump side of quarter-turn valve. Equipped with ¾-in. discharge tip on nozzle. While turret nozzle is in use, a 2½-in. hose line can also be used from the other discharge valve on the pump. When not in use turret nozzle folds onto platform.

Chassis: Pumping unit, including tank, is mounted on double I-beam and angle iron chassis welded into an integral unit. Steel safety ladder and non-slip steel platform is provided for nozzle operator.

WASHING RIG—Special self-contained pumping unit, consisting of turret nozzle, 1,200-gal. water tank and gasoline engine-driven centrifugal pump on skid, can be mounted on truck and put in field for washing insulators, on short notice. Three washing units have been built



CLEANING INSULATORS—Pumping unit in operation washing suspension insulators on energized subtransmission line. Motor throttle and shut-off valve on nozzle give operator complete control of water volume and pressure from platform. Chassis of unit is connected by cable to driven ground rod

During insulator washing operation, the chassis of the unit is grounded through a cable attached to an 8-ft. ground rod. The rod is provided with an integral "slug" or floating hammer that can be used to drive it into the ground either from the ground or from the truck. The pumping unit is always provided with its own ground. For obvious safety reasons the pumping unit should be kept away from "foreign grounds," such as station grounding systems.

While intended primarily for public

RM-listings cover step-down transformers in the range of 2400 to 66,000 volts. That your specifications can be met with "tailor made" exactness is demonstrated by the fact that the mechanical combinations shown here, applied over the full range of standard electrical ratings, furnish some 21,000 possibilities from which to make *your* selection.

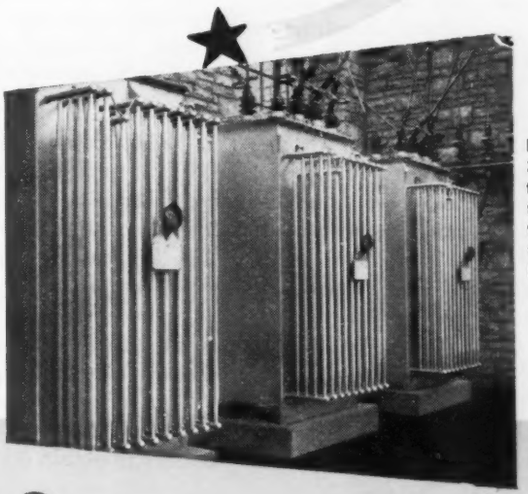
Savings are also made possible in providing additional margin for load growth and heavy short-time overloads, by using a somewhat larger RM-listed unit, which will cost less than a special "in-between" rating. (A 2500-kva, 22,000-volt RM-listed transformer will cost less than a special 2400-kva, 22,000-volt transformer.)

—YET DELIVERED "*Tailor made*" FOR YOUR JOB

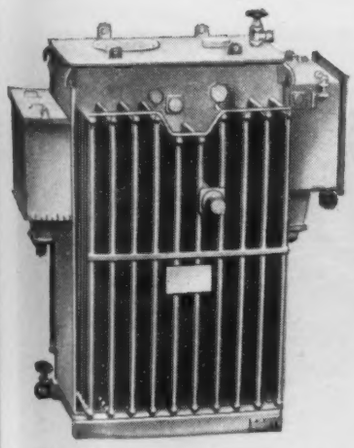
You have merely to study the factory-assembled transformer arrangements shown here in order to realize the extent of the logical and practical simplifications which have been made possible by RM design. Installation economies are apparent at first glance.

If you are considering the purchase of power transformers in the near future, it will pay you to ask for Bulletins GEA-4283 and GEA-4338A, which will give you complete data on RM design. Call your local G-E representative or write to *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

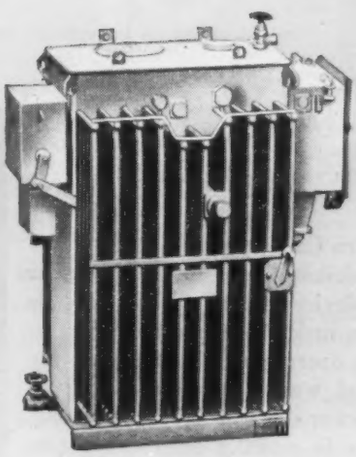
RM-LISTED TRANSFORMERS



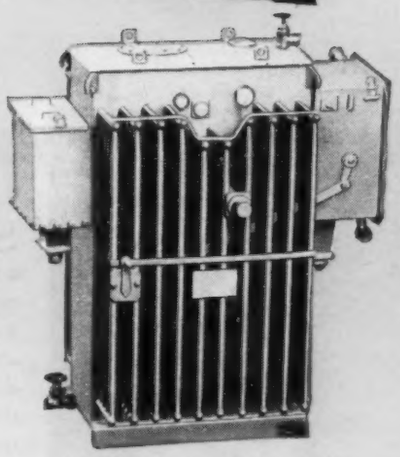
Installation of 3 G-E repetitive-manufacture power transformers with cover bushings.



H-V and L-V cable entrances without switches



L-V cable entrance with switch
H-V cable entrance without switch



L-V cable entrance without switch
H-V cable entrance with switch

GENERAL ELECTRIC

401-81-5188

utility service for washing insulators on lines and in substations the unit is also a formidable fire fighting tool. With pumping pressure and volume equivalent to fire department pumpers in the average small city, the unit would give an excellent account of itself at any fire, especially where normal water supplies are not available. The 1,200-gal tank could keep one or two high pressure fog nozzles in operation about a half hour.

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Recirculating Canal Reduces Ice Hazard

GEORGE HRUBESKY
Engineering Department
Wisconsin Public Service Corp.
Green Bay, Wis.

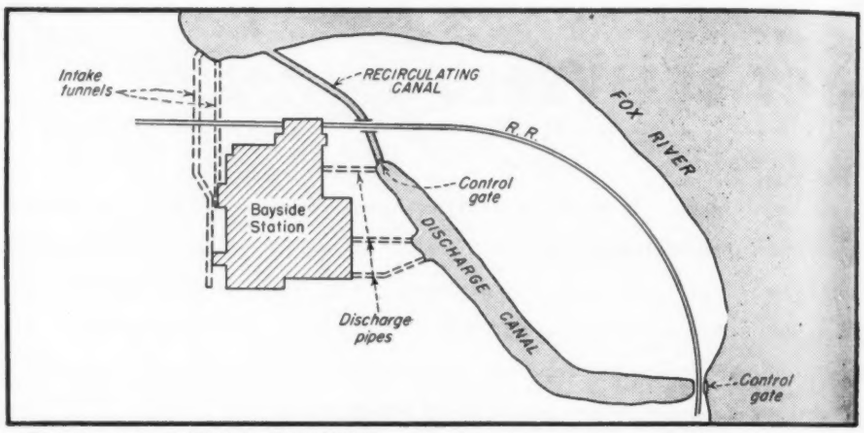
Frazil ice has been a problem at the Bayside Steam Plant of the Wisconsin Public Service Corp. since its construction in 1926. The plant was almost shut down completely three times due to ice forming on and plugging the trash racks at the intake. Due to the addition of a 30,000-kw. unit in 1942 and a similar addition under construction at the present time, the effects of a shutdown would be serious.

To eliminate this hazard, a recirculating canal has been constructed through which 0-80 percent of the condenser discharge can be diverted from the regular discharge canal to the bay directly in front of the intake trash racks. Relative location of the recirculating canal is shown in the illustration.

The canal, which is 10 ft. by 10 ft. by 300 ft. long, has vertical sheet-steel piling sides. Control gates are located in the recirculating canal and in the regular discharge canal. Although the gate in the recirculating canal is a single vertical lift gate, the one in the discharge canal has been divided into three openings, two of which have vertical lifts. The third will remain open, but provision was made for stop logs in case an extreme condition is ever encountered that would necessitate an increased amount of recirculated water.

Plan of operation is to adjust the gates before the critical period in December to obtain 40-to-42-deg. water at the condensers. It is believed this will prevent ice forming on the trash racks. However, if some extreme conditions should allow ice to pile up on the racks and endanger the operation of the plant, additional warm water can be diverted until a balance is reached.

After the critical period is over and Green Bay is frozen over, the recirculating canal will be closed to gain the efficiency due to colder condenser cooling water.



FRAZIL ICE DANGER REDUCED—By diverting condenser discharge from its regular canal and into the bay in front of intake trash rack, the threat of frazil ice formation has been reduced at this station. Control gates in the recirculating and discharge canals control amount of water diverted

• • •

One-Man Chain Saw

Southern California Edison Co. finds a motor-driven chain saw a handy labor saving device at its Alhambra pole yard. In order to convert the saw to one-man operation, the handle on the drive end was replaced with curved metal rocker shoes as shown. The one-man saw is actually safer to operate also, because when used as originally purchased, for two-man operation, the men were found following the obviously dangerous practice of putting their knees under the section of pole being sawed off to prevent splitting before the cut was complete.

CHAIN SAW is converted to one-man operation by replacing handles on drive end with metal shoes

METAL SHOES at extreme right end replace handle in converting chain saw to one-man operation

NOW A *Super* CORONOL CABLE

NEW BUTYL-BASE COMPOUND (GRI-8380)

for high-voltage cable insulation

BEATS RUBBER 9 WAYS

Remember prewar CORONOL—that fine high-voltage, ozone-resistant, rubber-like cable? Now, the best of oil-base natural-rubber insulation—as used in prewar CORONOL cables—has a successor that gives better results on every count important to cable life.

This new G-E insulation has a custom-built molecular structure, the base of which is butyl (synthetic) rubber. It is blended, compounded, and applied to the conductor by methods derived from G-E's full-range research. It is free from the "unsaturated" chemical bonds that make natural rubber subject to oxidation and aging. Thus, it is essentially inert to the action of ozone, sunlight, and oxidizing agents, and exceptionally resistant to acids, alkalies, and heat. (See table)

FIGURES THAT MEAN LONGER CABLE LIFE

PROPERTIES	SUPER CORONOL (Typical values)	CORONOL (Typical values)	IPCEA* REQUIREMENTS
Original Physicals			
Tensile lbs/sq in.	750	550	450
Per cent elongation	600	300	250
7 days 70C Geer Oven			
Tensile lbs/sq in.	700	450	400
Per cent elongation	525	225	200
48 hours 70C Oxygen Bomb			
Tensile lbs/sq in.	675	475	400
Per cent elongation	525	240	200
Cold Bend	—60 C	—15 C	—10 C
Power Factor	.010	.030	.050
Ozone Resistance	very good †	good	3 hours

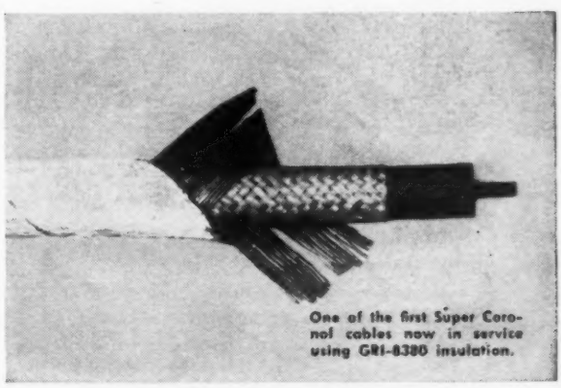
Long-Lived in Field Tests

In the field, as well as in the laboratory, the CORONOL cable made with the new butyl-base insulation has proved itself in a number of installations since early in the war.

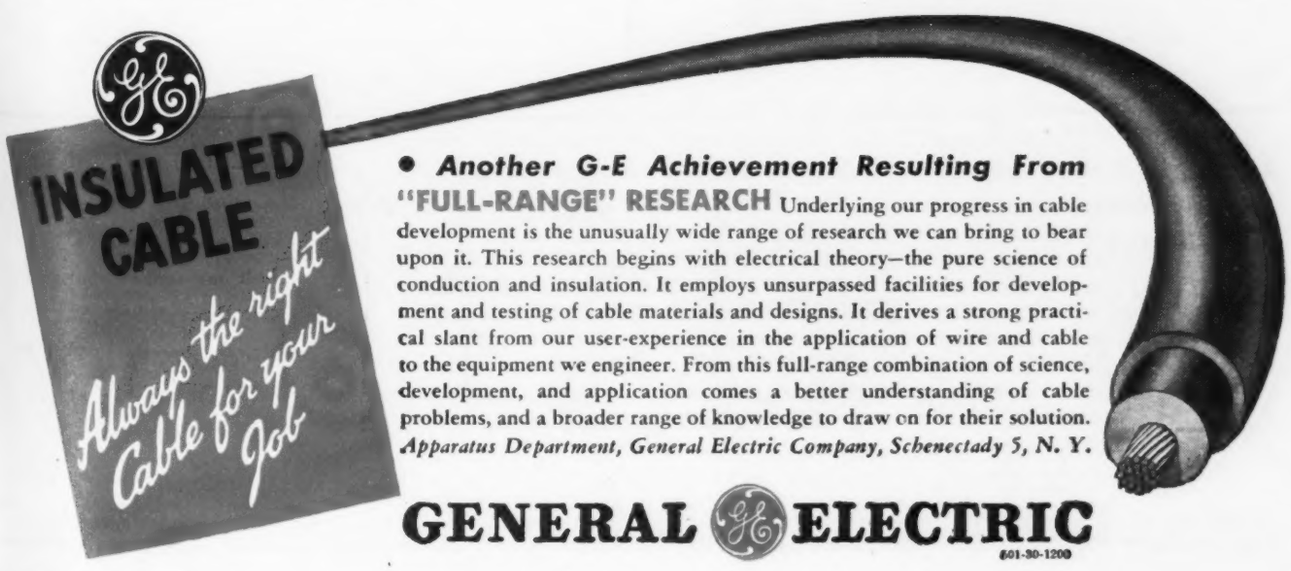
Of equal importance for the future are possibilities for extending the use of the new butyl-base compound to other insulated cables for a wider range of applications, higher voltages, and more extreme limits of temperature.

*Insulated Power Cable Engineers Association Specification for Ozone-Resistant Type Insulation

†Many samples have withstood 72 hours exposure



One of the first Super Coronol cables now in service using GRI-8380 insulation.



• ***Another G-E Achievement Resulting From "FULL-RANGE" RESEARCH*** Underlying our progress in cable development is the unusually wide range of research we can bring to bear upon it. This research begins with electrical theory—the pure science of conduction and insulation. It employs unsurpassed facilities for development and testing of cable materials and designs. It derives a strong practical slant from our user-experience in the application of wire and cable to the equipment we engineer. From this full-range combination of science, development, and application comes a better understanding of cable problems, and a broader range of knowledge to draw on for their solution.

Apparatus Department, General Electric Company, Schenectady 5, N. Y.

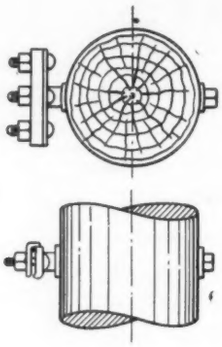
GENERAL ELECTRIC

601-30-1200

How to Install Messenger Suspension Clamps and Cable Safety Strap

An adaptation from Overhead Construction Standards of Central Hudson Gas and Electric Corp., Poughkeepsie, N. Y.

Fig. 1
3-bolt suspension clamp for 8,000 to 14,500-lb. strand, used on tangent pole

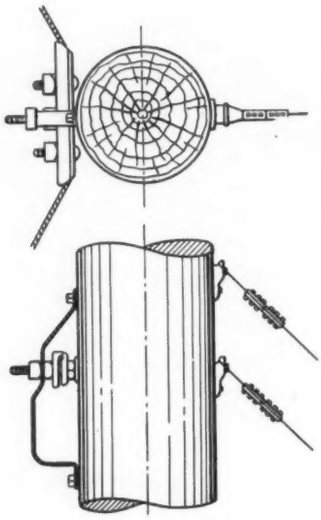


NOTE: Place suspension strand above bolt except where suspension strand pulls upward at dip in line. Place lip of clamp pointing toward pole except where pull on strand is against pole. Then place clamp so lip is pointing away from pole.

MATERIAL LIST

Quan.	*Description*
1	3-bolt messenger clamp
1	Galv. through-bolt, ⅝ in.
2	Square washer
1	Extra nut

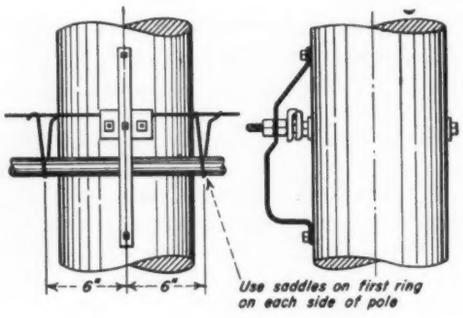
Fig. 2
3-bolt corner clamp, used on corner pole and angles up to 30 deg., 26-ft. pull



MATERIAL LIST

Quan.	*Description*
1	3-bolt corner clamp
1	Cable safety strap
1	Galv. through-bolt, ¾ in.
2	Galv. lag screw, ½ x 4 in.
1	Square washer
1	Extra nut

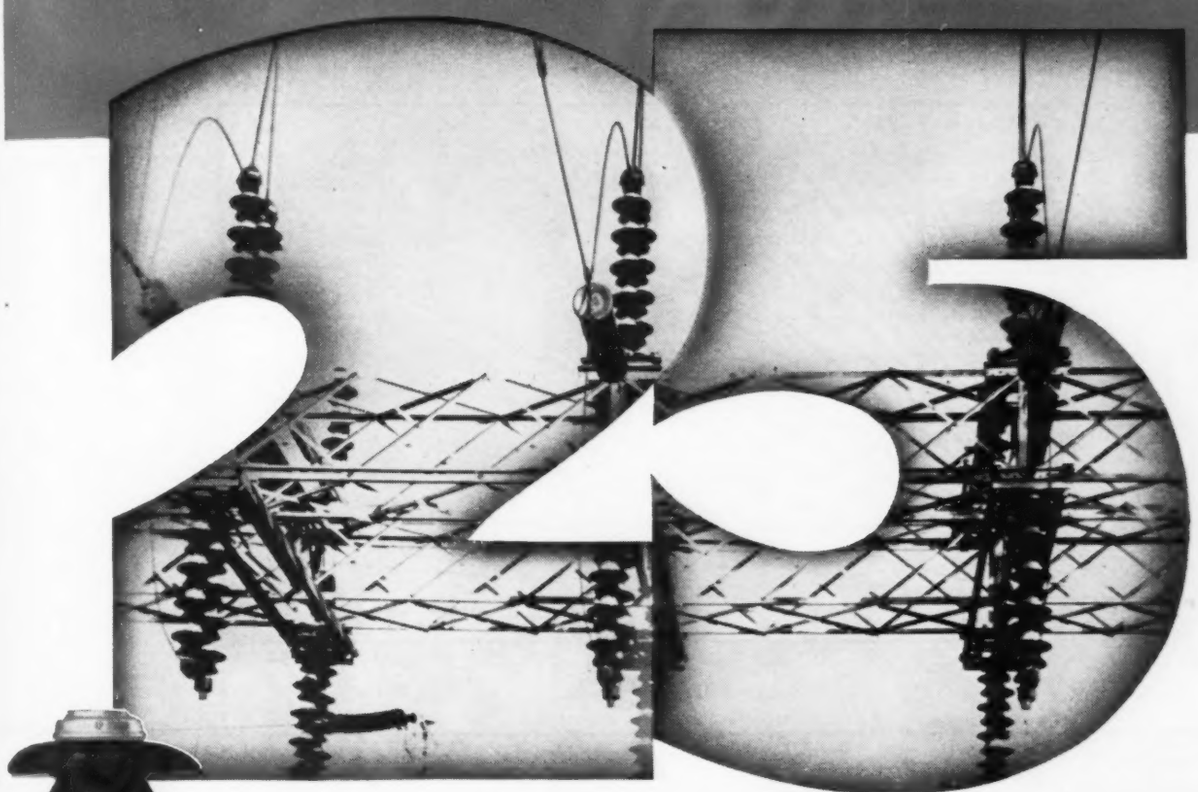
Fig. 3
Cable safety strap for use on all poles



MATERIAL LIST

Quan.	*Description*
1	Cable safety strap
1	2-bolt messenger clamp
1	Galv. through-bolt
2	Galv. lag screw, ½ x 4 in.
2	Square washer
2	Extra nut

THE "SILVER ANNIVERSARY" OF A SOUND DECISION



These O-B switch stacks are about to celebrate their twenty-fifth anniversary of constant service at 220 Kv., with no end yet indicated. Things that don't show, on sight or on test, account for O-B Insulator life--the thing you want most!

All switch and bus insulators *look* pretty much alike, but they don't *act* alike! When new, there isn't much difference, but they don't stay new! It's one thing to meet standard specifications with a unit fresh from stock, but it's something entirely different to continue meeting every *service requirement* for a quarter-century or more, with the end nowhere in sight... Many thousands of O-B switch and bus insulators have passed their "Silver Anniversary" of faultless performance. The ruggedness that was there when they were new--but didn't show--has been paying dividends and will continue to do so for years to come... After all, isn't this what you *really want* in an insulator? Then buy O-B!

Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD.,
NIAGARA FALLS, ONT.

HEADQUARTERS FOR PORCELAIN INSULATION

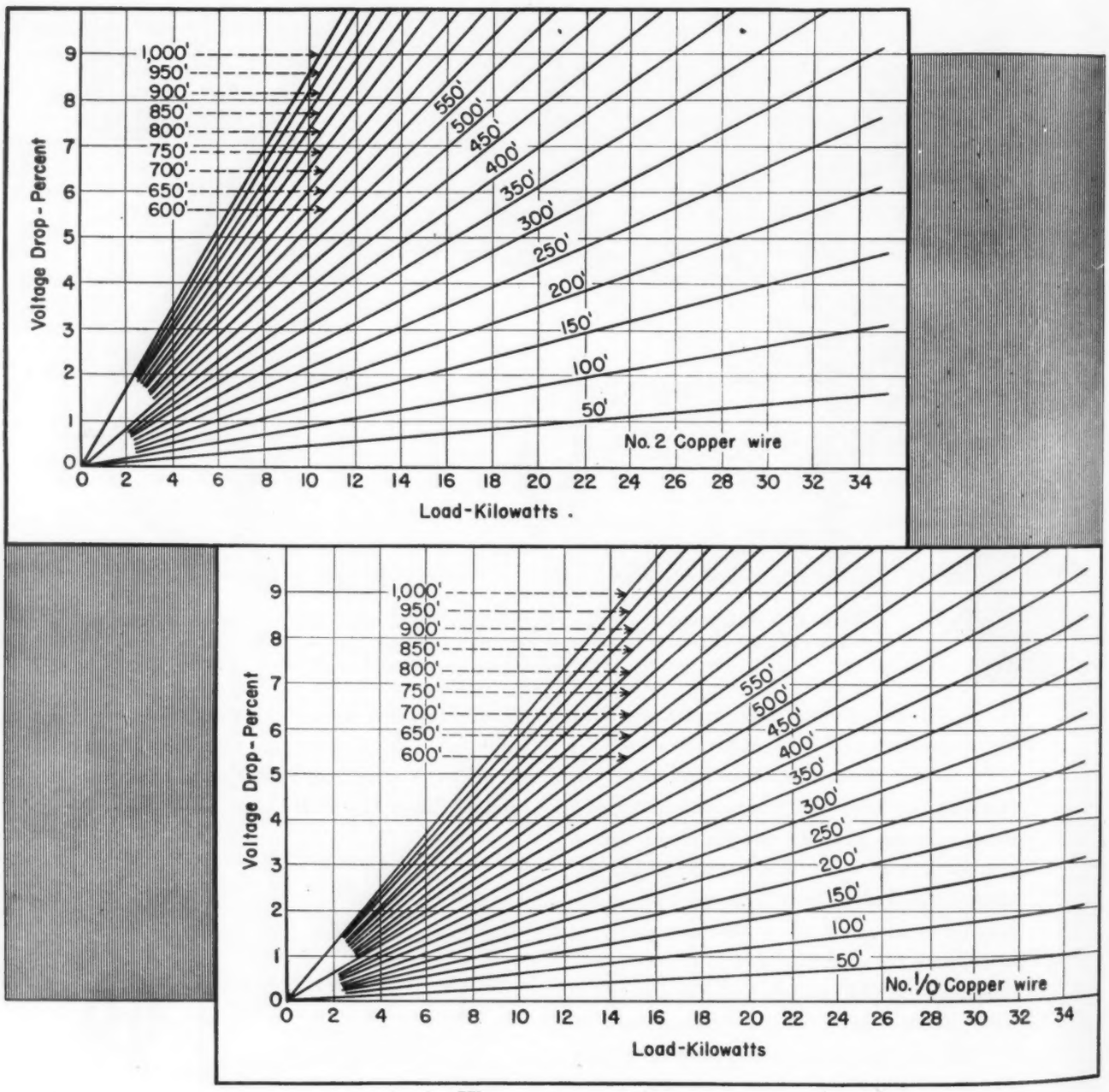
2648-H

Voltage Drop on Secondary Circuits With Unbalanced Condition—II*

(No. 2 and No. 1/0 Bare Copper)

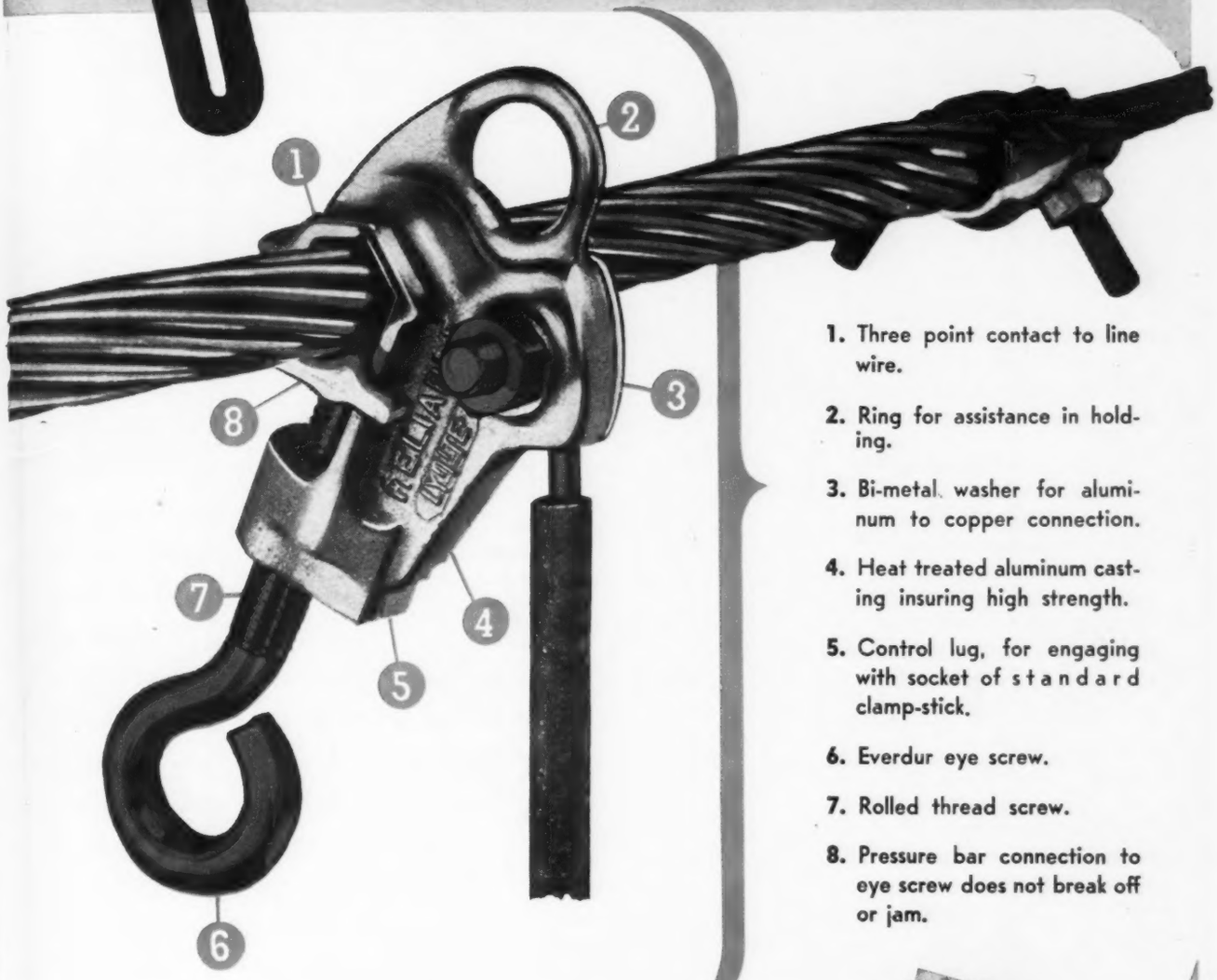
Curves give percent voltage drop for loads up to 35 kw. and for distances up to 1,000 ft. Circuit characteristics are: Bare solid copper conductors as indicated, 230 volts, 95 percent power factor, 15 percent unbalance, single-phase, 8-in. spacing.

PAGE W. CHOATE, Senior Engineer, Carolina Power & Light Co., Southern Pines, N. C.



* Similar surves for No. 6 and No. 4 conductors were published in ELECTRICAL WORLD, April 13, 1946, page 158; curves for No. 3/0 and No. 4/0 conductors will appear in an ensuing issue.

8 IMPORTANT Reasons ••FOR USING THESE DEPENDABLE HOT LINE CLAMPS



1. Three point contact to line wire.
2. Ring for assistance in holding.
3. Bi-metal washer for aluminum to copper connection.
4. Heat treated aluminum casting insuring high strength.
5. Control lug, for engaging with socket of standard clamp-stick.
6. Everdur eye screw.
7. Rolled thread screw.
8. Pressure bar connection to eye screw does not break off or jam.

SEND FOR NEW G-1 PRICE SHEET DATED 9-45 Listing all sizes available

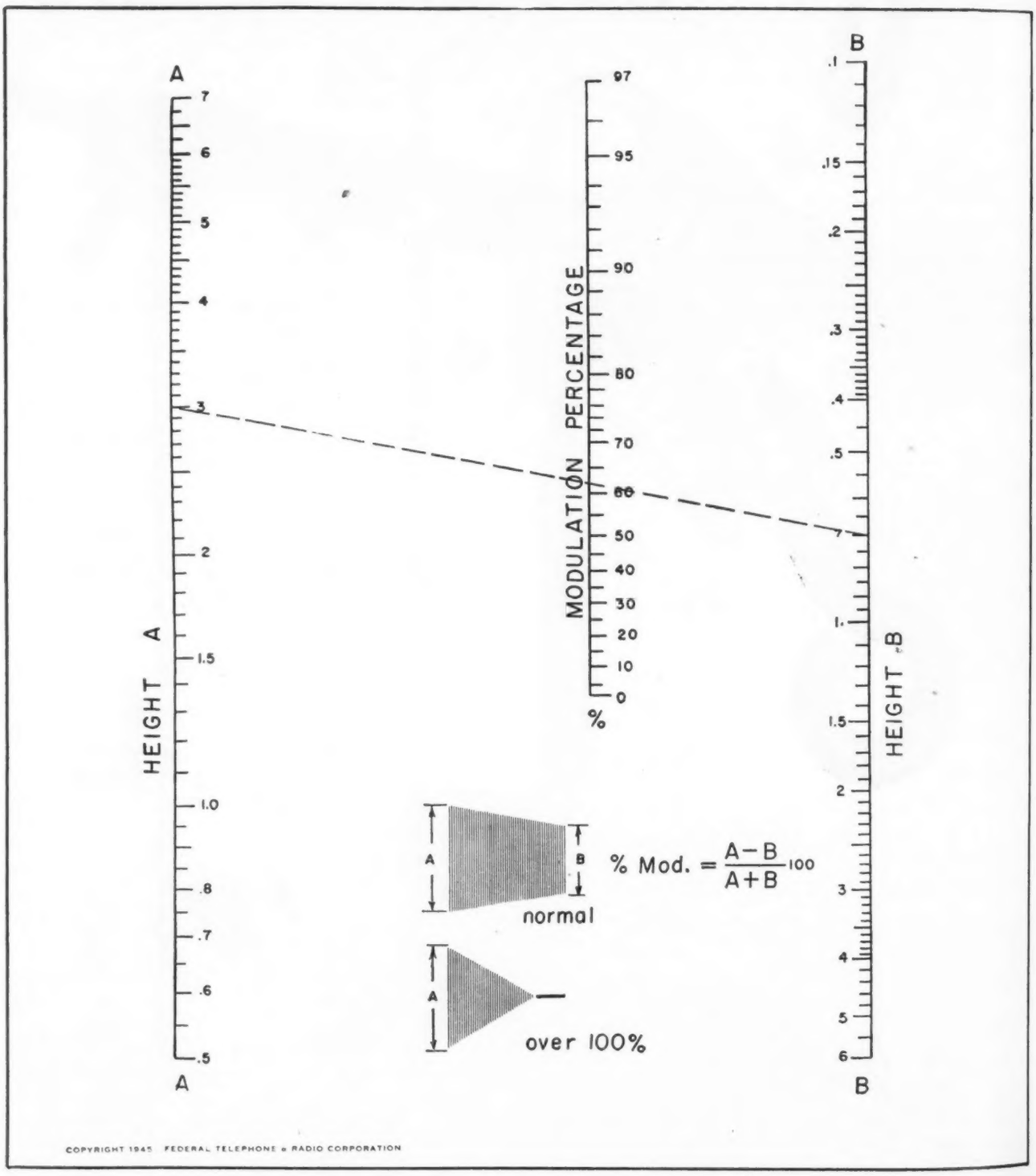
Reliable ELECTRIC COMPANY

3145 CARROLL AVENUE
CHICAGO 12

OVER 35 YEARS *Service* TO THE PUBLIC UTILITIES

MODULATION PERCENT FROM OSCILLOGRAMS

N. MARCHAND, Engineer, Federal Telephone and Radio Corp., New York



To determine the modulation percentage from an oscillogram of type illustrated apply measurements A and B to scales A and B and read percentage from center scale. Example: A=3 inches, B=0.7 inches; modulation 62 percent. Any units of measurement may be used.

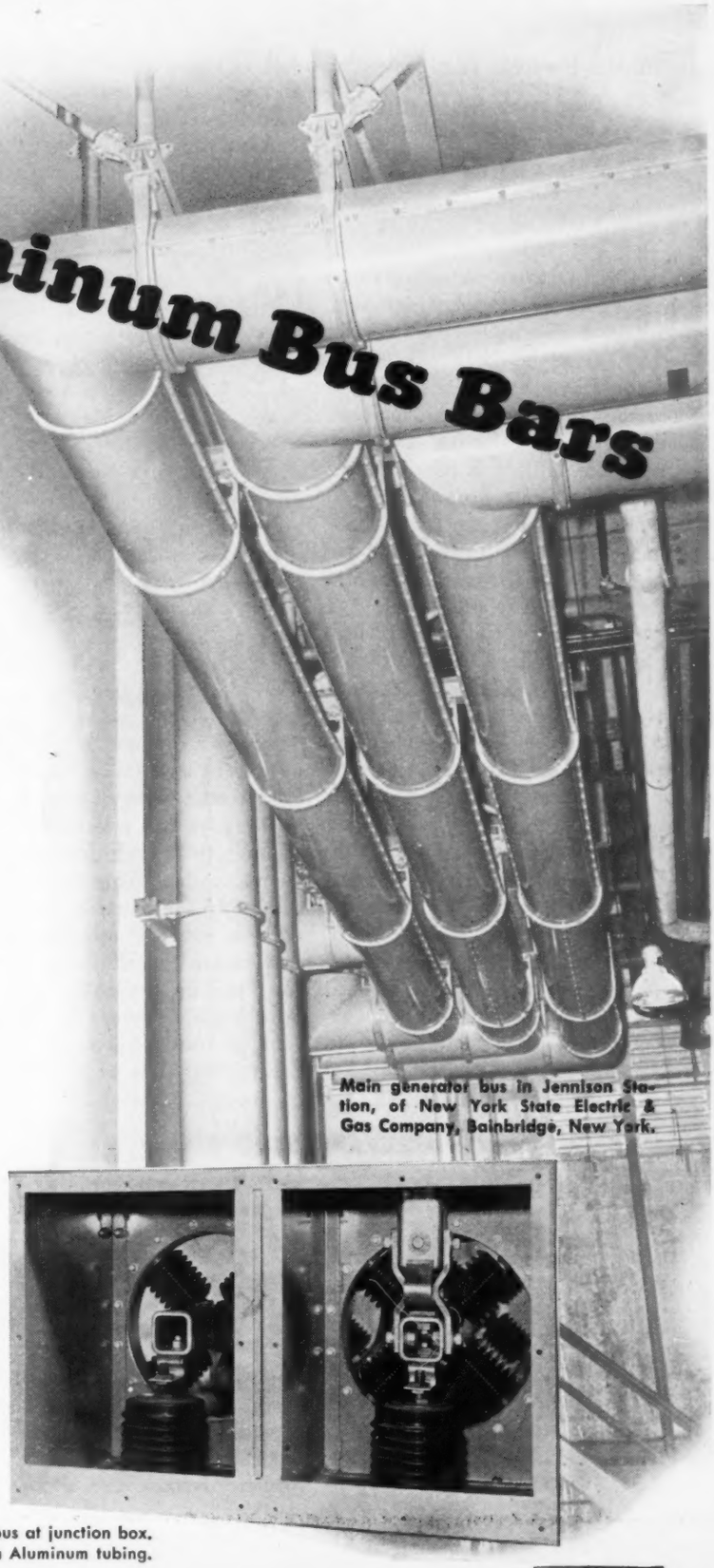
Alcoa Aluminum Bus Bars

Housed in Aluminum and Supported by Aluminum Brackets

• Here's Aluminum's best known property—light weight—employed to full advantage. Bus bars, hangers and housings are all made of Alcoa Aluminum, thereby simplifying installation and reducing the burden on supporting structures.

Of equal importance to the electrical engineer, housings are non-magnetic and heat is dissipated rapidly. Alcoa Aluminum bus bars have high electrical conductivity.

Indoor or outdoor substation, low capacity or high, Alcoa has the structural materials you'll require. For quotations, call the nearby Alcoa sales office, or write ALUMINUM COMPANY OF AMERICA, 2138 Gulf Bldg., Pittsburgh 19, Pa.



Main generator bus in Jennison Station, of New York State Electric & Gas Company, Bainbridge, New York.

Showing insulators supporting bus at junction box. Bus bars are 3½" square Alcoa Aluminum tubing.

ALCOA FIRST IN **ALUMINUM**

ALCOA ALUMINUM

Automatic Switch for Use On Network Secondaries

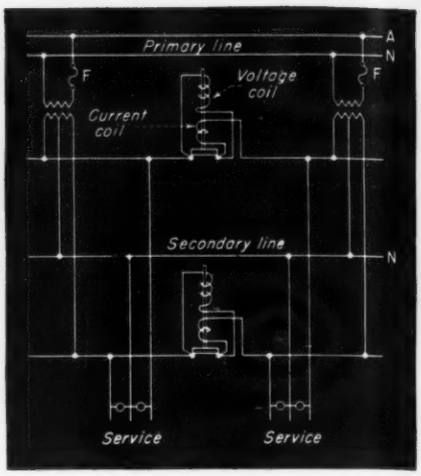
RALPH E. BROWN

San Antonio, Texas

For use at junctions on networks, a switch is being developed which will open automatically under fault conditions and close automatically when normal conditions have been restored. The device is to minimize blowing and replacement of transformer primary fuses near the fault and to eliminate possible burnout of a distant network transformer trying to carry the complete load and where the fuses have not blown. It is intended to be small, simple, reliable, sturdy and have a cost low enough to justify its use. This new automatic switch makes use of the fault current to open the junction point, and the voltage across the open junction to hold it open. The switch is to be marketed by the James R. Kearney Corp. of St. Louis.

Essentially the switch will consist of a current coil and a voltage coil, both coils acting in tandem on a plunger which in turn operates the contacts. The plunger is picked up at a predetermined value of current by the current coil, opening the contacts. At the instant of current interruption, under fault conditions, line voltage exists across the open contacts. The voltage coil is connected across the contacts and upon being energized will act to hold the contacts open.

After the faulted transformer's fuse has blown, the voltage coil will remain energized even after the secondary fault has been cleared, as a circuit is completed through customer's connected load, meter potential coils, the faulted transformer secondary winding, etc. This feature prevents the adjacent transformers from picking up the load of the faulted transformer. When the faulted transformer is re-fused, the voltage across the open contacts drops to zero, deenergizing the voltage coil and allowing the contacts to reclose. The voltage coil, being normally deenergized, does not introduce any losses on the system.



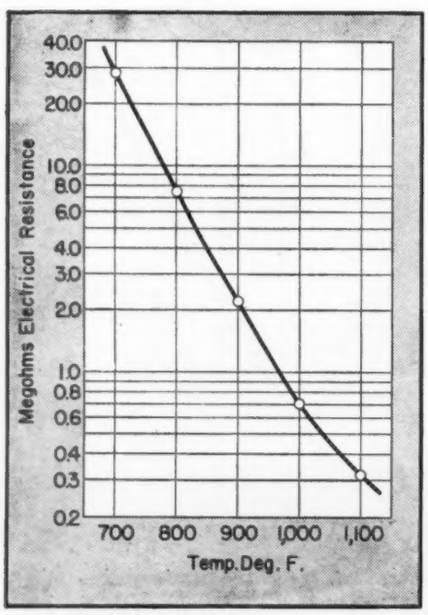
AUTOMATIC SWITCH applied to overhead 3-wire, single-phase network

Temporary Faults

On temporary faults which do not blow the transformer fuse, the switch will open momentarily, then reclose. There is no danger of pumping if the switch is located at the approximate load center between transformers and so long as the interchange of power through the switch does not exceed its current rating. This possibility is very remote as the tentative current ratings will be from 20 amp. up to possibly 100 amp. with a choice of from three to four ratings available. This range is approximately equal to full load current on transformers of 5- to 25-kva. rating, and sizes of the units may be chosen such that operations will occur only under fault conditions.

The voltage rating of the switch will be 120 volts. It can be applied to 120/240-volts, 3-wire, single-phase networks by using two units at each junction, one in each outside leg. On 240-volt, 3-wire, 3-phase networks it will be necessary to use three units at each junction. On 240-volt faults, two units will operate placing the 120-volt coils in series on 240 volts. In case of 120-volt faults, the unit on the faulted leg will operate first. The other leg will then feed the fault through the faulted transformer secondary winding acting as an autotransformer, causing the second unit to operate.

• • •



RESISTANCE at various temperatures

Steatite Tests Reveal Properties at High Heat

R. W. FERGUSON,

President, Star Porcelain Co., Trenton, N. J.

Tests recently performed revealed interesting data on electrical resistance, thermal conductivity, and expansion due to temperature rise of Lavolain, a steatite porcelain used to insulate oven, kiln and furnace leads electrically.

In making the electrical resistance tests, the measurements were made with a 1,000-volt d.c. megohmeter between a tight fitting steel electrode cemented with sodium silicate into a hole in the cylindrical test specimen, and a copper band which was tightly crimped around the central portion of the specimen. Contacts to each electrode were made positive by the use of platinum chloride. The specimen was 1.417 in. in length, had an outside diameter of 0.501 in. and an inside diameter of 0.125 in. The reading at 700 deg. F. was found to be 28.0 megohms and at 1,100 deg. F., 0.32 megohms. The accompanying curve shows the intermediate point readings.

The thermal conductivity was obtained by using a test specimen protruding 18 cm. from the furnace lid. The furnace temperature was maintained at 860 deg. F. for a "soaking period" of 7 hr. previous to taking any readings. The temperature at the point

ARMATURE assemblies fit when C-D MICABOND insulating rings and segments are used. They fit because C-D manufacturing standards assure close tolerance production of MICABOND materials and parts. The consistent quality and accuracy of C-D MICABOND products justify the confidence C-D MICABOND enjoys from the many manufacturers of armatures who specify C-D MICABOND. When your electrical insulating problem dictates "mica insulation," C-D engineers will be glad to help you to design to use mica to the best possible advantage—and in its most usable form—C-D MICABOND.

C-D PRODUCTS

The Plastics

DILECTO—Thermosetting Laminates.

CELORON—A Molded Phenolic.

DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.

HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

DIAMOND Vulcanized FIBRE

VULCOID—Resin Impregnated Vulcanized Fibre.

MICABOND—Built-Up Mica Electrical Insulation.

Standard and Special Forms

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

Descriptive Literature

Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

Continental·Diamond C-D Engineered Dielectrics

KYC-46

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Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911—NEWARK 15 • DELAWARE

with a

Midget "Megger"* INSULATION TESTER

Making important check tests of insulation resistance is a one-man job with any type of "Megger" Insulation Tester. For example, the illustration shows our Midget type being used for a periodic test on one of a group of fire-pump motors. After making connections, the operator merely turns the crank of the hand generator—and reads resistance directly on the scale. It is done as simply and quickly as the telling.

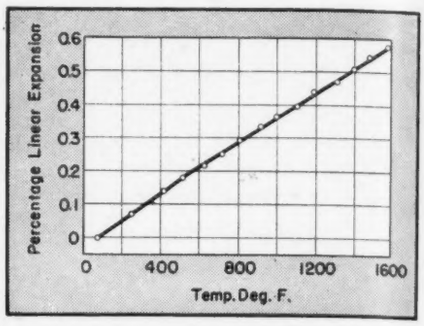
The Midget "Megger" Tester is ideal for maintenance and trouble-shooting because of its light weight, small size and ready portability. The hand-cranked generator makes it independent of batteries or external power supply—it is instantly ready for testing insulation resistance of almost any type of electrical equipment. Reads up to 50 megohms and delivers 500 volts d-c. Supplied also in ratings of 10 megohms, 100 volts and 20 megohms, 250 volts.

For periodic maintenance tests or where trouble has occurred the Midget "Megger" Tester has won wide favor with the men who use it. Its low cost has been attractive. For complete description write for Bulletin 1785-W.

** By special arrangement with the British makers of "Megger" instruments our American-made models carry the U. S. Registered Trade-mark "MEGGER".*

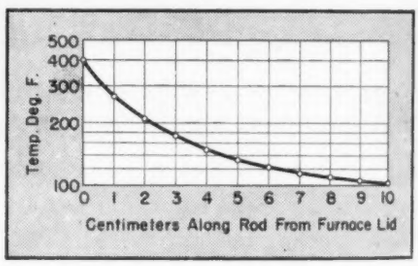
JAMES G. BIDDLE CO. • 1316 ARCH STREET PHILADELPHIA 7, PA.

where the specimen entered the furnace was found to be 400 deg. F. and decreased markedly as shown by the accompanying curve.



LINEAR thermal expansion curve

The linear thermal expansion of the material was studied between 75 deg. F. room temperature and 1,590 deg. F., which was the highest temperature that could be accurately maintained with the laboratory equipment. At this temperature the linear expansion was found to be 0.83 percent on the specimen which was 6 in. long and 0.44 in. in diameter.



THERMAL conductivity curve

The material is used in making ball and socket type beads for electrically insulated flexible leads and has been successfully used at temperatures up to 2,100 deg. F.

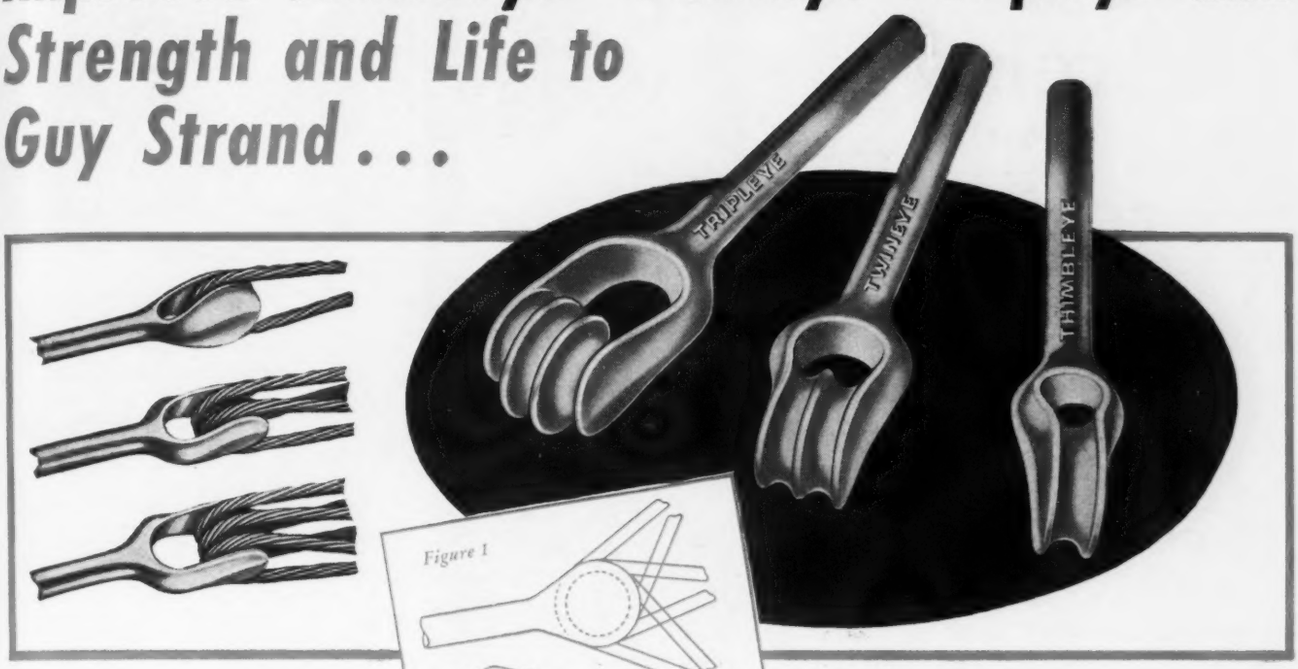
•

Vacuum Lifters Remove Distribution Box Covers

A vacuum cup lifting device that was originally marketed to facilitate the handling of plate glass has been adopted by meter testers and service men of Dallas Power and Light Co. who must get into distribution boxes that are "let" into decorative store fronts and covered with flush panels of glass or marble.

These cover slabs, more often than not, are completely devoid of "hand holds" and frequently fit so close to adjacent panels that use of a pry runs

Improved **Thimbleye • Twineye • Tripleye** *add Strength and Life to Guy Strand . . .*



Grooved to fit and protect Guy Strand

Full rounded to prevent kinking at any angle

You will instantly recognize the change in Thimbleye, Twineye, and Tripleye anchor rods and guy fixtures as being a definite improvement in appearance and an added protection to guy strands. The streamlined appearance is the result of improvements designed to give more complete protection to the strand at varied angles of pull, the objective being to further minimize any hazards to line security caused by kinked, distorted, or broken strands of cable.

The improved eye is drop forged on the rod as a perfectly shaped thimble and the sidewalls and groove of the eye extend all the way around the head of the rod. (See Figure 1, above.) This keeps the strand from flattening under tension, preserves its natural roundness, and prevents it from kinking at any one point. All grooves conform, in depth and width, to the largest cable size used with each rod or guy fixture. Grooves are deeper and give better support to the guy strand.

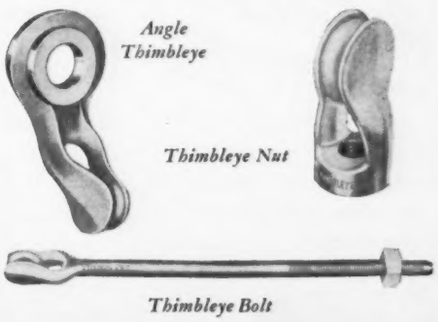
Always specify Thimbleye, Twineye or Tripleye rods and fixtures. Your nearest jobber can supply you.

THE NEW IMPROVED EYE:

1. ***MAINTAINS*** full support of guy strand at all angles.
2. ***PROTECTS*** strand and prevents flattening under tension or kinking on angle pulls.
3. ***PREVENTS*** injury to galvanizing and consequently rusting of guy strand due to kinks, bends, and breaks.
4. ***AIDS*** slacks pulling — guy strand passes through eye easily without kinking, bending, or binding.
5. ***ECONOMICAL*** to install and maintain.
6. ***IMPROVES*** appearance of any guying installation.

Thimbleye Guy Fixtures

Can be used singly or in a variety of combinations. Guy may be attached to fixture while lineman is on the ground and then mounted on the pole, slack being pulled on the ground at the anchor end.



Angle Thimbleye

Thimbleye Nut

Thimbleye Bolt

C463

ABC INDUSTRIES

A·B·CHANCE CO· CENTRALIA, MO.

CHANCE IMPROVED THIMBLEYES MANUFACTURED AND DISTRIBUTED BY THESE LICENSEES:

Joslyn Mfg. & Supply Co., Chicago, Ill. — N. Slater Company, Ltd., Hamilton, Ontario — Kortick Mfg. Co., San Francisco, Cal.

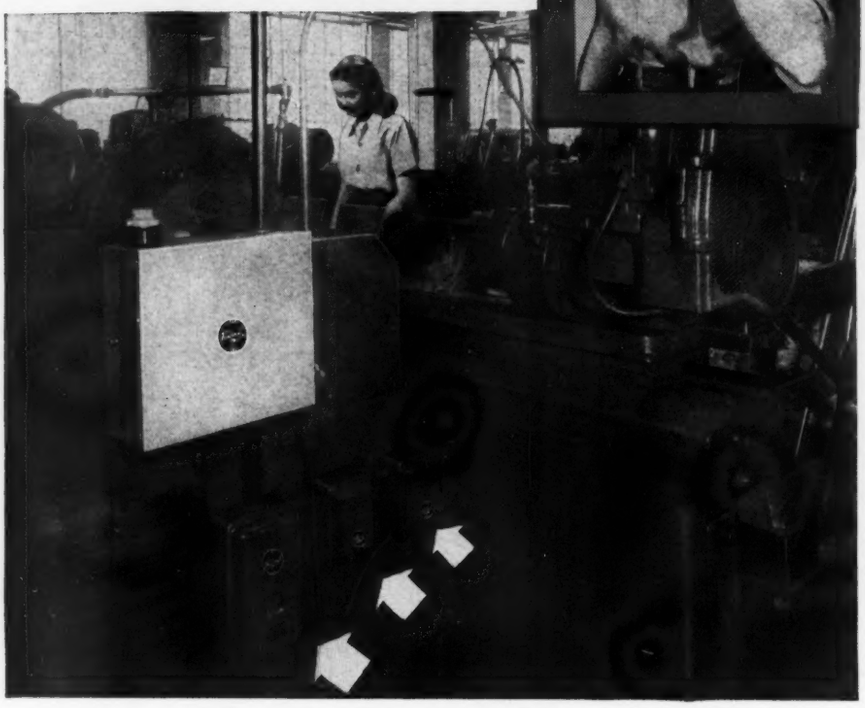
Line Material Co. . . . Milwaukee, Wis. — Seyler Mfg. Co. . . . Pittsburgh, Pa.

SHE DOESN'T KNOW A

relay

FROM A

resistor



YET SHE CAN BE THANKFUL FOR THE BUILT-IN DEPENDABILITY OF

Federal NOARK MOTOR CONTROLS

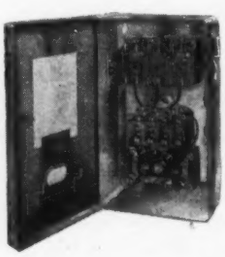
Like "ol' man river", her machine just keeps rolling along. Yet, behind the busy scene, often out of sight and out of mind, you'll find electrical control equipment bearing the honored name of Federal. Designed and built for year-after-year dependability, Federal products are specified wherever performance characteristics are measured in terms of production.

Federal NOARK

FEDERAL ELECTRIC PRODUCTS COMPANY

Executive Offices: 50 Paris St., Newark 5, N. J.

Plants: Hartford, Conn. and Newark, N. J.



Federal Noark Combination Motor Starter: Bulletin 514 Size 1, 250v, 60 amp. fusible for motors up to 5 hp; equipped with motor circuit disconnect switch.

DETACHABLE HANDLES—Attached to rubber vacuum cups, these handles facilitate removal of the marble cover plate of a distribution box installed in decorative store front. Handles provide convenient "hand hold" on close-fitting cover and are removable

the danger of chipping the material. The lifters eliminate this danger by providing two firm handles by which the cover can be pulled off and set aside.

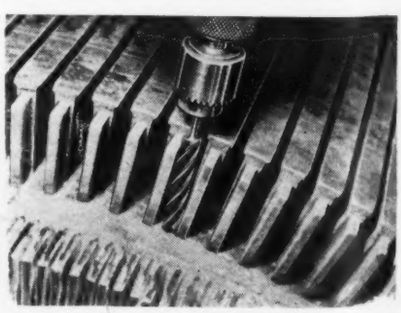
As the picture shows, the lifters consist of two rubber suction cups of about 3-in. diameter linked by a metal handle. Provision is made for breaking the suction when the lifters are to be removed. Each suction cup is claimed to have a holding power of 60 lb., thus each lifter can handle 120 lb. Servicemen in Dallas are each provided with two such "Eveready" lifters in a compact wooden box.

•

End Mill Used To Clean Semi-closed Slots

A method which makes use of an end mill to clean old insulation and dried varnish from armatures after stripping has been evolved by engineers in the Middle Atlantic District Maintenance and Repair Shop of Westinghouse Electric Corp. and is shown in the illustration.

Formerly a file was used to clean these slots; but since this method



END MILL with recessed shank in drill facilitates cleaning of slots

Melmac Plastic...

LIFE PRESERVER FOR A METER

Practically all insulation failures caused by condensation, deposits of foreign matter, or from high-voltage surges were eliminated when Sangamo Electric Company began using MELMAC plastic for terminal blocks on all single and polyphase watt-hour meters.

Extensive tests were made to find a general-purpose plastic that could be easily molded, and which possessed the right combination of mechanical strength and resistance to arcs or arc tracking. The plastic material formerly used, when exposed to an ASTM arc-resistance test, showed the formation of a conducting carbon path when exposed to arcing for only 5 or 10 seconds. Tests of MELMAC plastic showed an arc resistance of 120 seconds.

Cyanamid's MELMAC plastic 1500 has found many other applications in electric equipment where arc resistance is of utmost importance. Its use in circuit breakers, switch plates, connector plugs, terminal blocks, motor-brush studs and insulating parts provides longer life and added safety.

If you want longer life for the plastic in your electrical equipment, write or call our New York office.

TYPICAL PROPERTIES OF MELMAC 1500

General-Purpose, Arc-Resistant Industrial Plastic

	Average
Bulk factor	2.4
Specific gravity	1.45
Flexural strength, psi	11,000
Shrinkage, In./in. (4" x 1/8" disc)	
Mold, Immediate	.008
After 8 hrs. @ 220° F.	.0015
Total aging shrinkage 48 hrs. @ 220° F.	.0055
Water absorption (%)	0.38.31
Arc-resistance (ASTM) secs.	110-120
Dielectric strength (.080")	
Room temp. (S/T) v/mil.	465-365
100° C. (S/T) v/mil.	375-290

AMERICAN CYANAMID COMPANY*
PLASTICS DIVISION
34 ROCKEFELLER PLAZA · NEW YORK 20, N. Y.

**Reg. U. S. Pat. Off.*

Cyanamid Plastics
BEETLE* · MELMAC* · MELURAC* · LAMINAC* · URAC*

The Makeup of *Outstanding* Panel Boards

20 ASCO Remote Control Switches Help Control 20 Plating Circuits

Several requirements led to the choice of ASCO Switches for the service to be rendered by these Charging Panel-Boards built by The Udylite Corporation of Detroit.

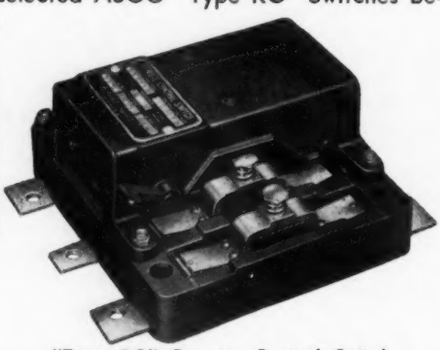
1 . . . **The remote switches had to be positive in action—with minimum voltage drop at high current since plating voltage was 6 volts.**

2 . . . **They had to be compact to fit in available space.**

3 . . . **They should preferably be quiet with no hum or coil losses; therefore, mechanically held.**

Udylite, after investigation, selected ASCO "Type RC" Switches because they so well fulfil its requirements.

Perhaps the "Type RC" is what you need for your requirements . . . or perhaps it would be some other ASCO Automatic Switch, Relay or Contactor. Why not find out about our quality line of Switches?



"Type RC" Remote Control Switch

ASCO Electrically Operated SWITCHES

We also manufacture a complete line of Solenoid Operated Valves for automatic and remote control of liquids and gases.

Automatic Switch Co.

41-C EAST 11th STREET • NEW YORK 3, N. Y.

proved to be very tedious and laborious, a substitute method was sought.

A setup using an end mill with a recessed shank placed in an air drill proved to be quite successful; the shank is recessed so that the end mill can be moved freely in the slot. A girl now uses this method to clean armature slots with a savings of approximately 90 percent of the time formerly spent in doing this work.

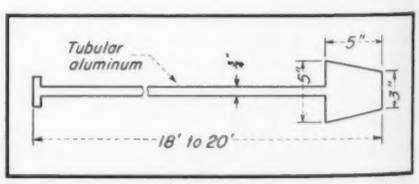
This method may possibly be applied to other cleaning operations where space or the opening may be quite restricted.

•

Aluminum Coal Poker Aids Boilermen

To facilitate freeing coal during night shifts in the bunkers feeding the high-pressure boilers at the United Illuminating Co.'s Steel Point station in Bridgeport, Conn., W. R. Sierer of that division designed an aluminum poker with spade end to replace existing poker equipment.

The plant had been using a wooden pole 18 ft. long and a poker made from steel pipe ¾ in. in diameter and 20 ft. long. The wooden pole was light to handle, but was full of slivers, and presented some danger of breaking, falling upon the coal scale belt and jamming when the bunker was low. In winter the coal has to be poked on all



THREE-QUARTER-INCH aluminum tube with spade end designed to replace wood poles used in coal bunkers feeding high-pressure boilers

shifts, and a 20-ft. length of steel pipe was unsatisfactory to handle.

The use of aluminum rod ¾ in. in diameter and 18 to 20 ft. long was suggested and pokers of this design adopted by the company. If experience over a period shows that some other material than flattened aluminum is needed, an end of steel or other metal may be provided, in view of the probable difficulty of obtaining cast aluminum in such a shape.

Because of the basic importance of adequate wiring to the entire electrical industry, Anaconda is presenting messages like this in a wide list of national publications

Wire ahead FOR FULL PRODUCTION

WHEN ELECTRIC POWER costs so little... and other costs are rising, no management can afford to overlook adequate wiring.

Obsolete wiring, overtaxed wiring can reduce machine efficiency, and hence worker efficiency, from 25 to 50 per cent.

For, when power fails, the productivity of the most ambitious, the most conscientious, the most skilled workmen you have must drop accordingly.

Talk over your wiring problem *now* with your plant power engineer, your consulting engineer, electrical contractor or power salesman. It may save expensive alterations later.

These men *know*, as you suspect, that postwar production depends on postwar wiring.

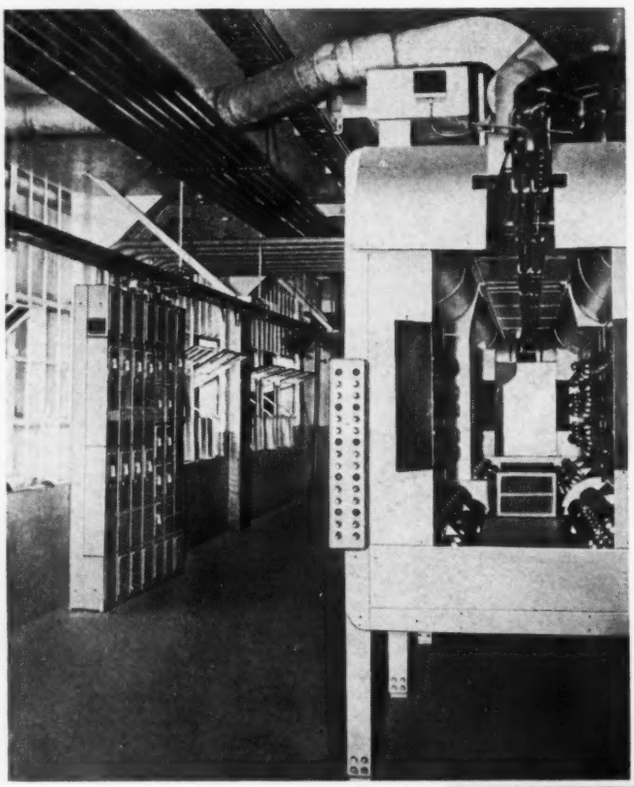
46316

ANACONDA **ANACONDA WIRE & CABLE COMPANY**

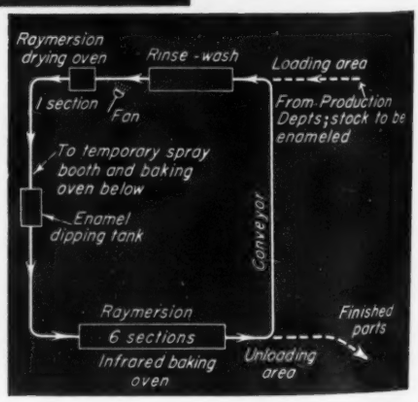
LOAD BUILDING

Automatic Baking Doubles Production Per Man-Hour

PRELIMINARY EXPERIENCE with a "Raymersion" infrared electric oven at the Plainville, Conn. factory of Trumbull Electric Mfg. Co. indicates a man-hour saving of about 50 percent in producing about 60,000 lb. of work per week. This is an engineered installation involving a conveyorized layout about 350 ft. long, with facilities for washing and rinsing the steel switch boxes and parts treated, drying, dipping and baking in a cycle of approximately 45 minutes between loading and unloading points. The oven was manufactured at the company's Norwood, Ohio, plant, and the Trumbull organization also designed and built the control center from which all operations are automatically directed. This work was formerly gas-dried after spraying or hand dipping. The set-up of the present process is shown in the accompanying schematic diagram.



END VIEW of infrared baking oven, right center, and control center, left, for enameling switch boxes and parts. Lamp circuits are subdivided to give high flexibility in operating panel assemblies inside oven, which is sectionalized to provide preheating, temperature elevation and temperature holding zones



SCHEMATIC DIAGRAM of washing, drying, dipping and baking cycle in production of switch boxes at Trumbull plant

Processing Steps

Parts are hung on racks designed to eliminate runs and drags and are carried into the wash unit for cleaning by high-pressure spray utilizing a commercial cleaner. The racks then are conveyed to the rinse unit where hot, clean water is sprayed on the parts to remove all traces of the cleaning compound. In the rinse water is a small amount of "wetting agent" which tends to reduce the formation of droplets, cutting down surface tension and capillary action, thus speeding up evaporation and facilitating heat transmission in drying. The drying oven, a single section "Raymersion" unit, contains ninety-six 375-watt infrared lamps, or 36 kw. total, and operates at about 150 deg. F., six heating panels being provided.

From the drying oven the work proceeds to a 650-gal. tank containing synthetic enamel and thence to a six-section baking oven 36 ft. long, approximately 9 ft. high by 55½ in. wide, the interior working zone being about 24 in. by 30 in. Normally a 6-min. bake is applied at 300 deg. F. The oven is socketed for about 200 kw. in 250-watt, 120-volt infrared bulbs, but at present from 125 to 135 kw. suffices, the demand varying with the type of work and air conditions. Operation is in three zones, the first being for preheating by convection; the second a temperature elevation zone with an energy dispersal of about 6 watts per sq. in.; followed by a holding zone using 2 to 3 watts per sq. in. The oven is designed for 375-watt bulbs if desired. The preheating zone covers about 10 percent of the oven length, and takes out the last of the volatile gases in the enamel. From this oven the work is carried to the unloading area. There are 288 sockets in this oven. Twelve switch boxes can be carried per double section of the conveyor, and the range in conveyor speed attainable is from 3 to 9 ft. per min.

The control center has seven panels of Trumbull design. Half a panel is used by the drying oven; three panels control two baking oven sections each; and the rest control the main 440-volt power supply, auxiliary service blowers, pumps, a 1.5-kva. transformer for 110-volt control circuit applications,

and 1.5-hp. motor for driving the conveyor. Emergency stop buttons are available at strategic points for cutting out service.

It is estimated that the total cost of the departmental installation is about $25,000, including drying equipment, bake oven, control center, wiring, lamps, blowers, a spray booth destined for service elsewhere. About 160-kw. total demand from the department is at present noted.

Drying Seed Corn Ears With Forced Heated Air

ARTIFICIAL DRYING of seed corn ears soon after harvest is necessary to avoid damage from freezing and mold. It involves reducing moisture content of the corn to less than 14 percent in a short time using heated air under forced circulation. Air temperature should not exceed 110 deg. F. to avoid danger of reducing the percentage of germination.

Methods and equipment involved in drying seed corn ears in bins by forced hot air circulation have been observed by H. J. Barre, formerly with the Department of Agricultural Engineering, Iowa State College at Ames, Iowa, upon whose findings* this article is largely based.

For successful bin drying, air movement must be positive to force air through deep layers of corn for thorough, rapid drying. Principal equipment includes a heating unit and one or more drying bins as shown.

Bins are provided with a false floor and have an opening at top and bottom for air to pass. Bottoms are usually slatted, using 1- by 4-in. boards an inch apart and supported 12 to 18 in. above the floor for best air distribution before entering the bin.

Depth of corn in bins may vary from a few feet to 12 ft. A depth of 6 to 7 ft. is common where more than one bin is used. Capacity of bin dryers refers to the amount of corn dried in a day or season from 30 percent moisture to 12 percent. Well designed systems can dry a bin charge in three days.

Air requirements recommended for rapid, satisfactory drying at various depths of seed ear corn are given in Table I. Selection of fans for forced circulation of the hot dry air through the drying bins depends on three factors: (a) cubic feet of air to be moved per minute, (b) static pressure required to move air at the desired rate through the bins, and (c) how the load may vary.

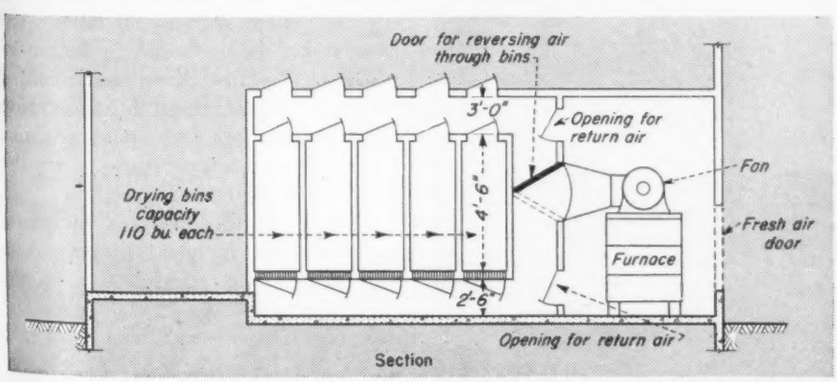
Volume of air to be moved can be determined from Table I, knowing the bin floor area and number of bins.

TABLE I
Air Requirements For Bin Drying of Seed Corn Ears At Various Depths

Depth of Corn in Bin (Feet)	Flow of Heated Air per sq. ft. of bin floor (cu. ft. per min.)
4	40
6	55
8	65
10	80
12	90

Air pressure of 1 in. of water is usually used in selecting fans for moving 60 cu. ft. per sq. ft. of bin floor per min. through 7 ft. of corn. Centrifugal multi-bladed fans are most commonly used, as they are capable of delivering large quantities of air against pressures encountered in bin drying. Belt driven fans are preferred over direct-connected fans since choice of pulley size permits selecting desired

* Agricultural Engineering Bulletin No. 155.



SEED CORN DRYER forces dry, heated air at 110 deg. F. from furnace through seed corn ears in bins to reduce moisture content and prevent damage from freezing or mold. Provision included for changing air flow

How to design, construct, and calculate performance of POWER-TRANSMISSION LINES

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General Engineer, Carolina Power and Light Company

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- Mechanical properties for copper, copperweld-copper, and A.S.C.R. conductor
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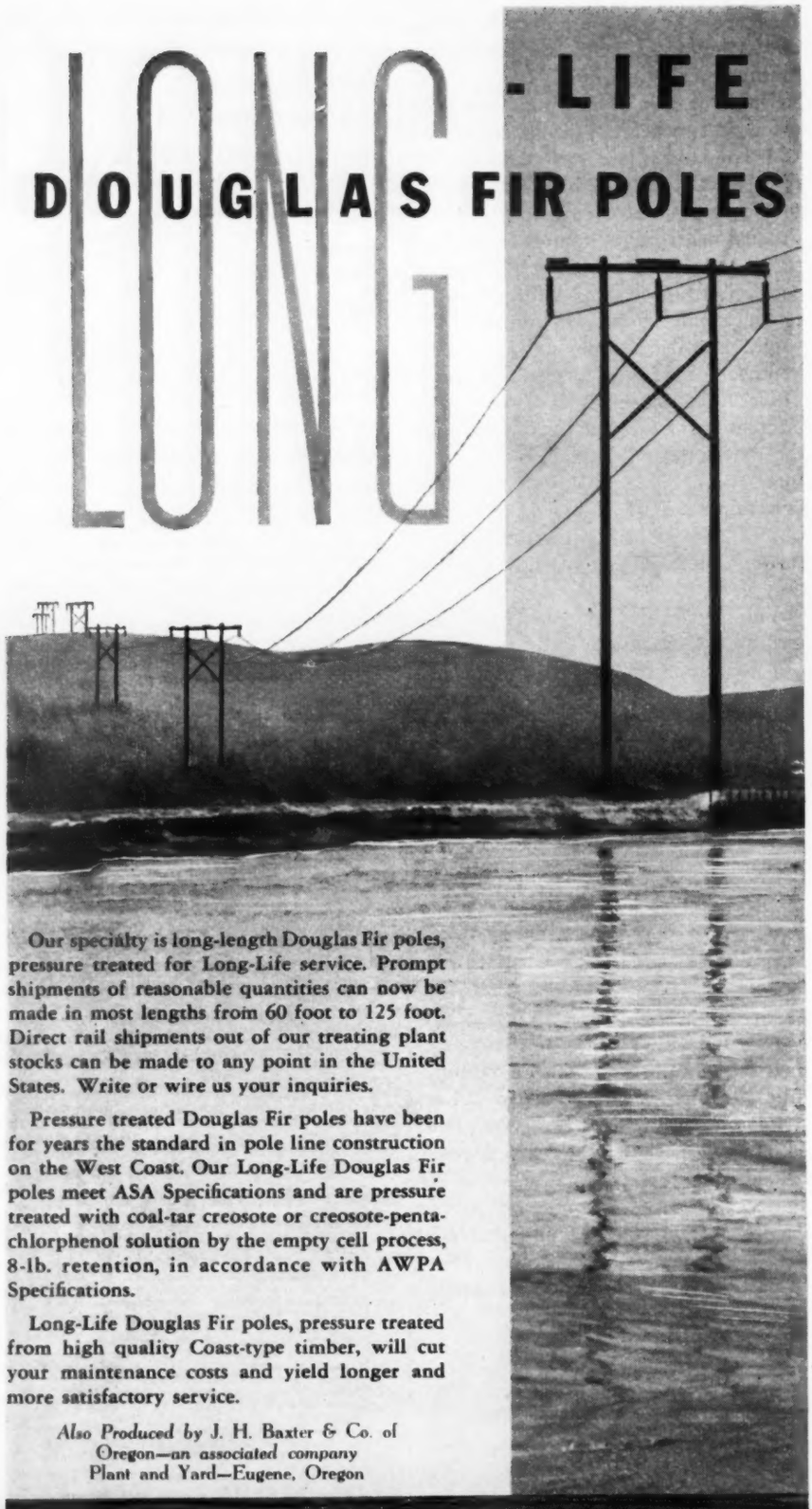

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desired fan speed for a given motor.

Horsepower ratings of fans to deliver different quantities of air against various resistances are usually available from manufacturers. Table II indicates the horsepower required for moving various quantities of air through 6 to 8 ft. of corn assuming air requirements of 60 cu. ft. per min. per sq. ft. of bin floor against a head of 1 in. of water.

TABLE II

Fan Horsepower Required to Deliver Different Quantities of Air

Cubic Feet Per Minute	Horsepower Required
2,500	¾ to 1
5,000	1⅞ to 2½
7,500	2½ to 4
10,000	3 to 6½
15,000	4 to 10
20,000	5 to 11
25,000	7 to 13
30,000	8 to 15

Data based on corn thickness of 6 to 8 ft. assumes air requirement of 60 cu. ft. per min. per sq. ft. of bin area against 1 in. head.

The size of the heating unit required for bin drying depends on (a) quantity of air moved through the bins and (b) the lowest sustained outside temperature expected. Recommended maximum heating capacity and fuel requirements to heat different quantities of air are shown in Table III. Automatic heating equipment such as oil burner and coal stoker is preferred in larger installations because of automatic control features. Hand fired furnaces have been very satisfactory in maintaining fairly constant temperatures in smaller units when firing is frequent.

TABLE III

Recommended Capacities of Heating Units for Various Air Requirements

Quantity of air movement (cu. ft. per min.)	Recommended heating capacity (Btu's per hr.)	Required Quantities of fuel per hr. Coal-lb.	Oil-gal.
2,500	87,500	13	1.0
5,000	175,000	26	1.9
7,500	263,000	40	2.9
10,000	350,000	53	3.9
15,000	525,000	80	5.7
20,000	700,000	106	7.6
25,000	875,000	132	9.6
30,000	1,050,000	160	11.5

Cost of building bins and equipment varies widely. In new buildings where all equipment is purchased, cost may vary from $1.25 to $2.00 per bu.; in buildings already available costs may run from 75 cents to $1.25 per bu. Operating costs of driers in Central Iowa have ranged from less than one to ten cents per bu.

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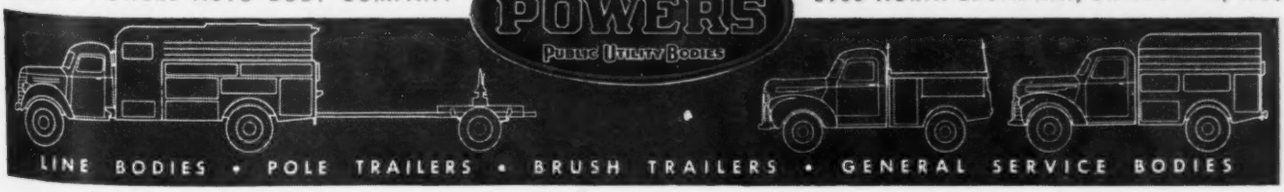

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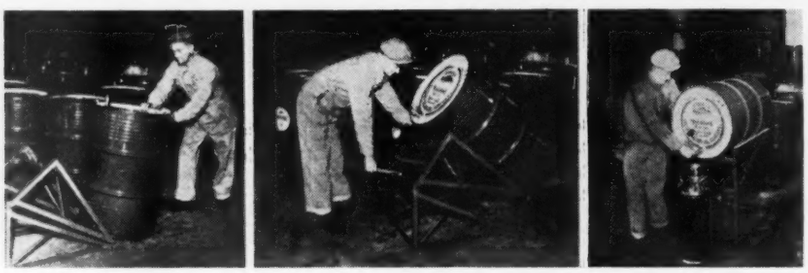
NEW EQUIPMENT

Rack Makes One-Man Job Of Handling 700-Lb. Drum

A NEW RACK has been designed by the Revere Electric Mfg. Co., 6009 Broadway, Chicago 40, Ill., to simplify the transferral of insulating and lubricating oils from the 55-gal. drum to smaller containers.

It consists of two electrically welded steel frames hinged together and these open and close by a hand-crank actuated worm, thereby raising the drum to dispensing position. The report states it makes the handling of a 700-lb. drum a one-man job.

Rollers are provided to move the rack about and these are inoperative when the drum is being tilted into position.



• • •

Mobile Capacitor Unit for Emergency Kvar. Cutting

A MOBILE, 4,150-volt, capacitor unit that is expected to be of considerable value in handling emergency or seasonal overloads was built recently by the General Electric Co., Pittsfield, Mass.

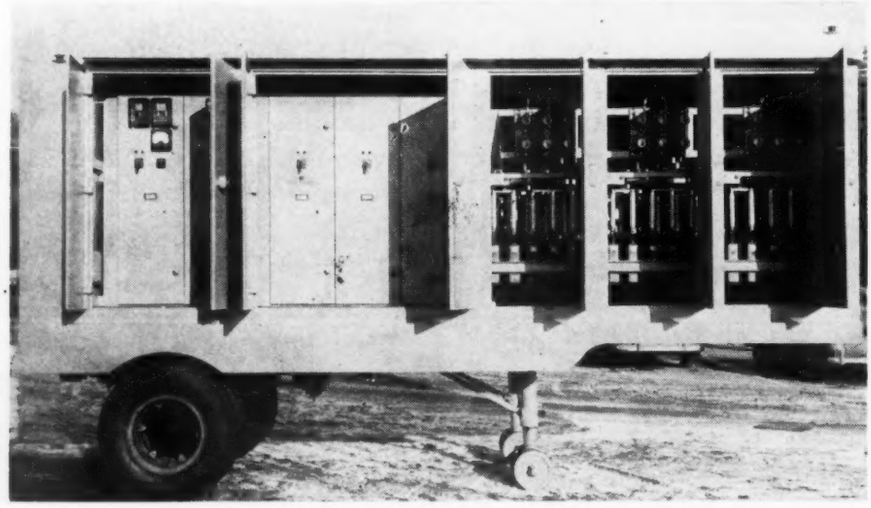
The new unit, designed to supply local emergency demands for kilovars and to make possible full-scale field testing of feeder lines to determine correct capacitor needs, consists of six 180-kvar. banks of Pyranol capacitors mounted on a Fruehauf Model 5 semi-trailer chassis.

Three of the banks are arranged for automatic control and three for manual, the former using built-in, magne-blast circuit breakers. A main magne-blast breaker protects the unit itself from short circuits.

The capacitor equipment is connected to the lines by means of cables carried on reels in a rear compartment, which also houses tools required for installation and operation. These cables, equipped with hot line clamps, permit connections to be made to lines without interruption of service.

One of the important uses of this mobile unit which was designed for Consolidated Gas, Electric Light & Power Co. of Baltimore will be to sustain voltage at rural or suburban substations while maintenance work is performed on high-tension supply feeders. The substations in such cases are tied together through the 4-kv. system.

In addition to obvious emergency uses, such as correcting local overloads resulting from a major feeder outage, the mobile unit can be used to aid in carrying seasonal resort loads that are temporarily exceeding the ratings of the feeders and can be used for a similar purpose in the case of feeders having a short winter peak.



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Automatic Water Level Control for Stock Tank

A NEW water level control unit for use in controlling the proper level in stock watering tanks has been announced by Rocklin Mfg. Co., Sioux City, Iowa.

An electric mercury switch and sealed control unit comprise the control. The switch is tilted by the float and provides the make and break contact which automatically starts and stops the pump jack motor. The mercury actuating control is counterweighted to provide positive action within the fixed water levels and to prevent false starts and stops due to water waves in the tank.

The unit is provided with grounding facilities as a protection for the livestock and is completely enclosed in a case as a protection against damage from the animals.

•

New Flowmeter Made In Three Different Styles

THE ADDITION of a bellows-differential flowmeter to its line of mercury manometer flowmeters is being made by the Bristol Co., Waterbury 91, Conn.

The new instrument, known as the Bellows-Differential Flowmeter, will be made as a mechanical flowmeter, as an electric flowmeter, and as a pneumatic-transmission flowmeter in a complete line of recording, indicating, integrating, and automatic controlling models.

The meter body, operating on a new principle, is said to require no mercury in its operation. A unique method of transmitting bellows motion to the pen arm is employed, which is said to isolate completely the meter-body shaft from the measured fluid.

•

Magnet Charger Surge Above 15,000 Amperes

COMMERCIAL VERSION of a model first built for the armed services, the RFL Model 107 portable magnet charger, designed for use in production lines, instrument repair shops, laboratories, is announced by Radio Frequency Laboratories, Boonton, N. J. It

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For more than 100 years, Hubbard and Company has enjoyed the privilege of serving industry with its greatly diversified products of the durable goods class.

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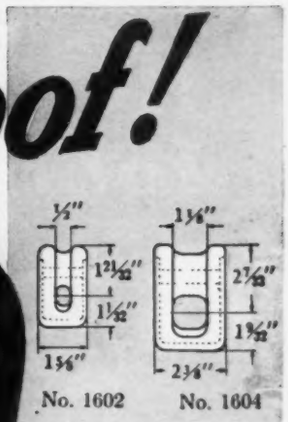
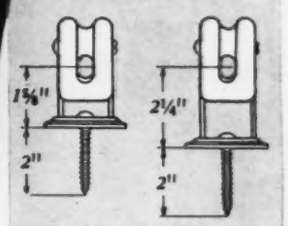
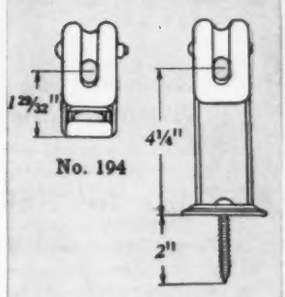
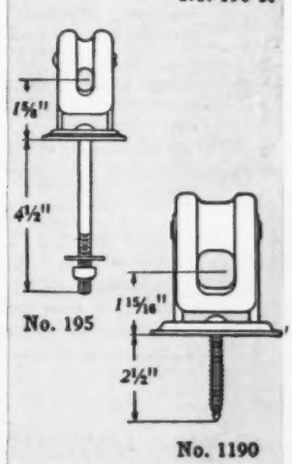
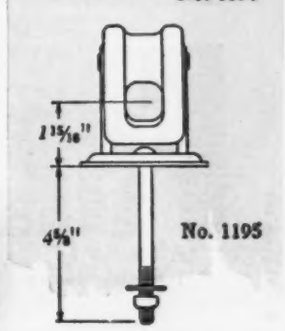
This old, reliable design with its variations shown here, is the favorite of many engineers and linemen from coast to coast. They know, that in thirty years of service, the Hubbard No. 190 has encountered every hazard to which a wireholder may be exposed. They know it has a slender pointed, full threaded screw for easy starting and maximum holding power in sheeting or solid wood. They know that its strength is much greater than that of the average service wire. They have discovered that this strength is due to the fact that the porcelain insulator is in compression with metal supports, not in tension, which is the weakest state of porcelain. They have thirty years proof that the Hubbard No. 190 has what they want in a wireholder.











Stock No.	DIMENSIONS—INCHES				Approximate Shipping Wt. Lbs., 100 Pcs.
	Insulator	Size of Screw, Bolt or Tap	Extension Base to Ctr. of Wire Hole	Size of Wire Hole	
190	1602	No. 22 x 2 Wood Screw	1-5/8	9/16 x 3/4	105
190-A	1602	No. 22 x 2 Wood Screw	2-1/4	9/16 x 3/4	115
190-R	1602	No. 22 x 2 Wood Screw	4-1/4	9/16 x 3/4	150
194	1602	5/8 Tap	1-29/32	9/16 x 3/4	95
195	1602	3/8 x 4-1/2 Carriage Bolt	1-5/8	9/16 x 3/4	140
1190	1604	No. 24 x 2-1/2 Wood Screw	1-15/16	1-1/8 x 1-1/8	228
1195	1604	3/8 x 4-5/8 Carriage Bolt	1-15/16	1-1/8 x 1-1/8	240

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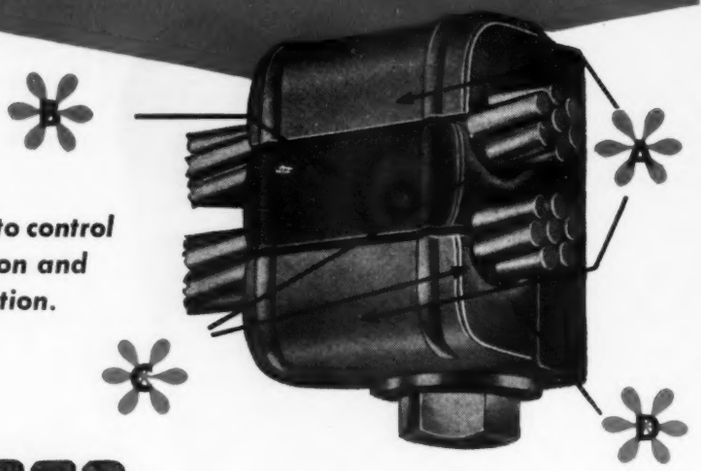

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FARGO 7000 heavy-duty Series

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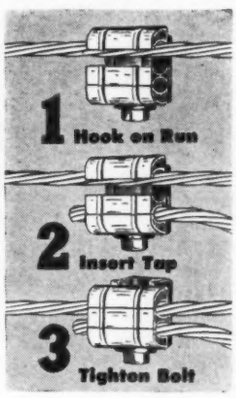

*A Wider Jaws provide greater area of contact, dispel heat, lessen fatigue and relaxation by reducing stresses on the conductor.

*B Spacer Bar of high conductivity copper distributes pressure equally over conductors being clamped. Relieves high stress at point where strands of two conductors are in contact.

*C Fitted grooves, conductor-shaped, keep all strands electrically in contact. Increased closure retards corrosion.

*D Rounded jaw edges prevent marring of conductor.

SIZES for 2/0, 4/0, 250MCM, 350MCM, 500MCM, 750MCM and 1000MCM conductors with taps of same size are immediately available from stock, subject to prior order. Heavy-duty connectors for tapping smaller sizes than the run are made to order from stock blanks at no extra cost.

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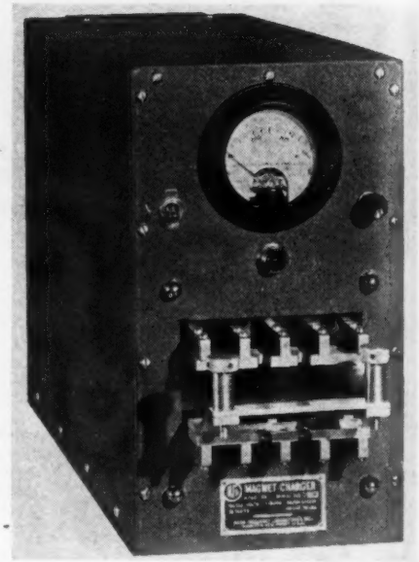


contains a condenser, an associated power pack and a current transformer through which the condenser bank is discharged. The transformer secondary is connected to a charging bar which is arranged for convenient association with the magnet for induction of the charging magnetic flux. The condenser charge is controlled by an ignitron type tube operated by a push button on the front panel.

The storage condenser bank has a capacity of 100 microfarads and is charged to approximately 500 volts. When the ignitron type tube is fired, the condenser is said to discharge in a small fraction of a second, producing a current surge in the charging bar exceeding 15,000 amp. peak value.

The unit measures 7 in. by 12 in. by 17 in., weighs 75 lb., is portable or may be bolted to a bench for production operations. It plugs into a 110/120-volt, 50/60-cycle outlet.

•

Rectifier Transformer Line Developed by Marcus

NEW LINE of air-cooled transformers, which was designed primarily for use with electroplating rectifiers and is reported applicable to the field of battery charging and with other types of rectifiers, is now being announced by Marcus Transformer Co., 32 Montgomery St., Hillside 5, N. J.

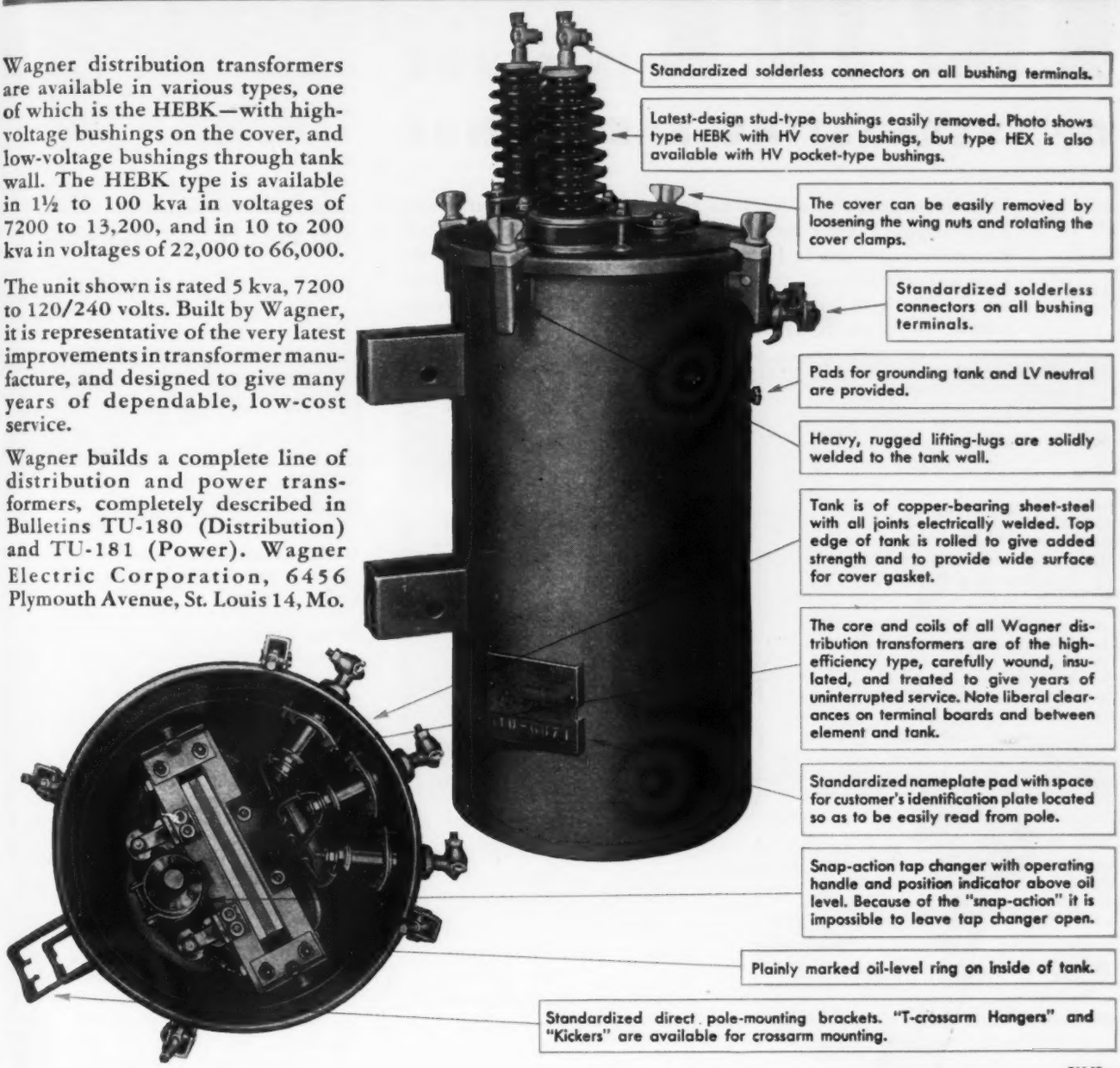
Units are available in sizes ranging from 500 va. to 500 kva., single and three phase,

Wagner Type HEBK Transformers

Wagner distribution transformers are available in various types, one of which is the HEBK—with high-voltage bushings on the cover, and low-voltage bushings through tank wall. The HEBK type is available in 1½ to 100 kva in voltages of 7200 to 13,200, and in 10 to 200 kva in voltages of 22,000 to 66,000.

The unit shown is rated 5 kva, 7200 to 120/240 volts. Built by Wagner, it is representative of the very latest improvements in transformer manufacture, and designed to give many years of dependable, low-cost service.

Wagner builds a complete line of distribution and power transformers, completely described in Bulletins TU-180 (Distribution) and TU-181 (Power). Wagner Electric Corporation, 6456 Plymouth Avenue, St. Louis 14, Mo.



Standardized solderless connectors on all bushing terminals.

Latest-design stud-type bushings easily removed. Photo shows type HEBK with HV cover bushings, but type HEX is also available with HV pocket-type bushings.

The cover can be easily removed by loosening the wing nuts and rotating the cover clamps.

Standardized solderless connectors on all bushing terminals.

Pads for grounding tank and LV neutral are provided.

Heavy, rugged lifting-lugs are solidly welded to the tank wall.

Tank is of copper-bearing sheet-steel with all joints electrically welded. Top edge of tank is rolled to give added strength and to provide wide surface for cover gasket.

The core and coils of all Wagner distribution transformers are of the high-efficiency type, carefully wound, insulated, and treated to give years of uninterrupted service. Note liberal clearances on terminal boards and between element and tank.

Standardized nameplate pad with space for customer's identification plate located so as to be easily read from pole.

Snap-action tap changer with operating handle and position indicator above oil level. Because of the "snap-action" it is impossible to leave tap changer open.

Plainly marked oil-level ring on inside of tank.

Standardized direct pole-mounting brackets. "T-crossarm Hangers" and "Kickers" are available for crossarm mounting.

T46-10

Other **WAGNER** *Products for Industry:*

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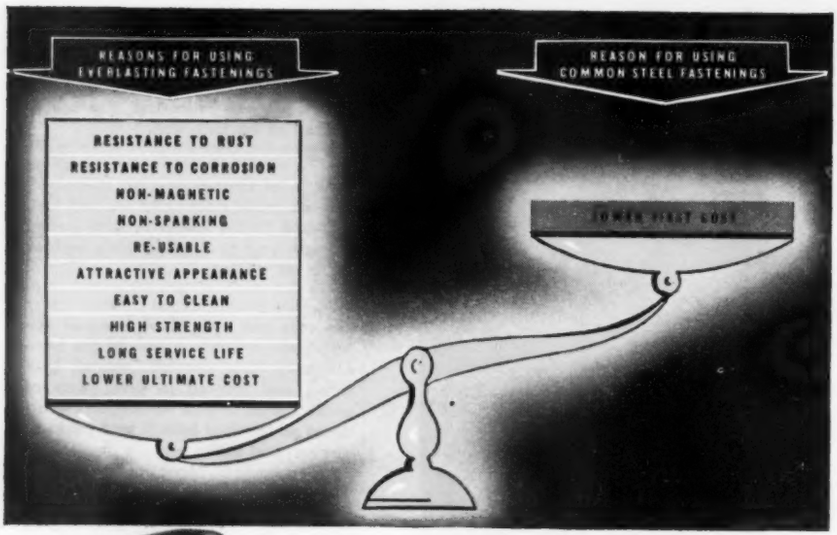

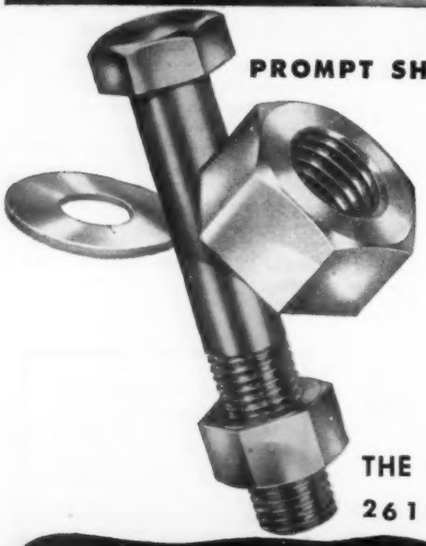

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Tapped primaries are provided for flexibility in secondary voltage and current range. Multiple secondaries and special variations are reported available to meet individual application requirements. Units are designed for use in circuits up to 550 volts.

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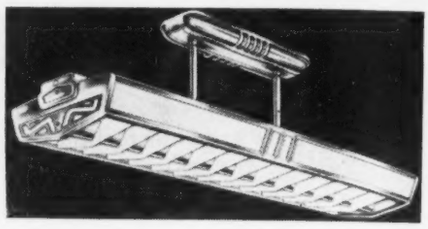
Commercial Fixture 100-Watt Design Out Soon

A NEW commercial fixture, called Viz-Aid, is being announced by DayBrite Lighting, Inc., 5411 Bulwer Ave., St. Louis 7, Mo. It



is manufactured for single or continuous fixture installation in both suspension and surface mounting types.

The fixtures are made for two rows of 40-watt lamps and will soon be made to accommodate two 100-watt fluorescent tubes. The design for these have been completed and the first sample will be on display at the International Lighting Exposition.

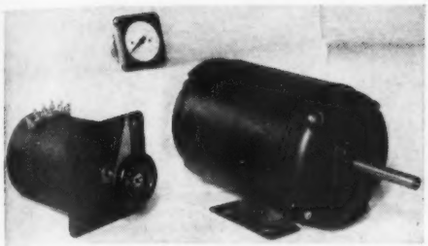
•

Positioning Equipment Operates on A.C. and D.C.

DIRECT CURRENT positioning and indicating equipment which can be operated from any a.c. or d.c. line is announced by the Allis-Chalmers Mfg. Co., Milwaukee, Wis., for general industrial use wherever remote indication and control systems are employed.

This equipment, consisting of receivers and transmitters, is expected to have wide application in oil fields, steel mills, steam or hydro-electric plants, and on shipboard, according to the manufacturer. Specific uses include governor and generator field control systems for multiple synchronized diesel-electric drives, master remote control for reversing mill motors, remote Ward Leonard control systems for multiple diesel-electric power plant mobile units, and remote indication or control over mechanical, electrical or hydraulic devices such as level, pressure and flow indicators.

Immediate receiver response without hunting or overshooting is reported attained over the entire operating range of the system. The receiver is a positioning unit in which the relative strength of the magnetic fields of the stator determines the position that its permanent magnet rotor will assume. Any change in this relationship of the field strength causes the rotor to turn and assume the position corresponding to the new resultant of the two fields. The receiver torque



is a function of the displacement between the rotor and the magnetic axis of the receiver.

The transmitter, which is essentially a variable resistance bridge, operated manually or automatically, controls the relative strength of the receiver magnetic fields. Receiver and transmitter torques are independent and the receiver torque required to move a device has no effect on the transmitter. The transmitter is designed to operate any number of receivers within rated capacity at any specified d.c. voltage.

In this d.c. system power requirements are essentially constant under all operating conditions. Overloading the receiver beyond its torque rating is reported not to damage receiver or transmitter.

Four leads are needed for each receiver and two power supply leads to the transmitter on most applications. All devices are designed with overlapping characteristics to afford maximum interchangeability, and the equipment is said to be readily modified to operate at any desired d.c. voltage.

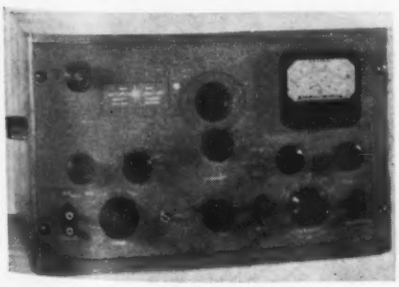
Six sizes now available range from 5 oz.-in. to 360 lb.-in. approximate pullout torque, and with a small drip-type rectifier unit may be operated on an alternating current.

•

Distortion Analyzer Covers Audio Spectrum

MODEL 330B distortion analyzer is a distortion-measuring instrument which uses a resistance-tuned circuit in conjunction with an amplifier. Hewlett-Packard, Inc., Palo Alto, Calif., manufacturers of the new product, state that the unit is capable of measuring distortion at any frequency between 20 cps. and 20,000 cps. It is reported to make noise measurements of voltages down to 100 microvolts. A linear r.f. detector makes it possible to measure these characteristics directly from a modulated r.f. carrier.

The circuit consists of a linear r.f. detector, a frequency-selective amplifier, a vacuum-tube voltmeter, and regulated power supply. The voltmeter section of the instrument consists of of a two-stage high-gain amplifier,



a rectifier, and an indicating meter. A large amount of negative feedback is employed to insure stability and a uniform response from 10 cps. to 100,000.

Circuit is stated to eliminate the fundamental by more than 60 db. and to attenuate the second harmonic and higher harmonics by less than 10 percent. Distortion measurements are said to be accurate within plus or minus 3 percent for distortion levels down to 0.5 percent.

Nine ranges are provided on the voltmeter with full scale sensitivities of 0.03, 0.1, 0.3, 1.0, 3.0, 10, 30, 100, 300. A calibration from + 2 to — 12 db. is also provided, and the ranges are related to each other in 10-db. steps. The range switch indicates db. level as well as voltage range. Zero level is 1 milliwatt in 600 ohms.

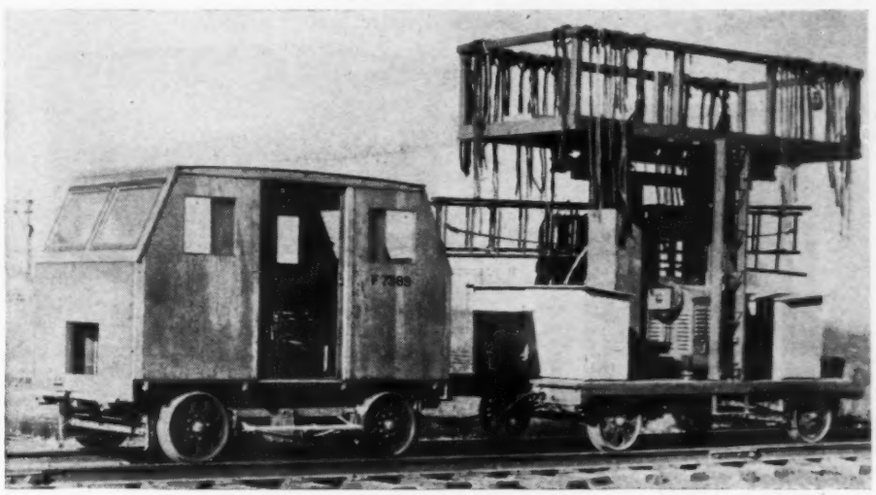
When used to measure hum or noise, the meter is reported to give a full scale deflection on a signal of 300 microvolts. Satisfactory readings are reported made to 80 db. below 1 milliwatt in 600 ohms. The instrument operates from a 115-volt 50/60-cycle power source, and draws 90 watts. It is mounted in an oak cabinet and front panel size is 19 in. x 10½ in.; depth is 13 in.

• • •

Insulated Platform Designed for Railroad Use

MOBILE heavy-duty tower lift for electrical maintenance and construction is a recent development of the Bird-White Co., 3119 West Lake St., Chicago 12, Ill. The platform is insulated for 1,500 volts and is said to provide ample working area for the crew.

Maximum elevation is reported as 22 ft. and, it is stated, that side sway has been virtually eliminated. Raising and lowering is accomplished by twin hydraulic-mechanical type columns electrically controlled from the platform. Power is supplied by a gasoline driven generator. A telescopic ladder can be used with the raised platform.



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Protective Coating Utilizes Synthetic Resin

A PROTECTIVE COATING stated to be resistant to acids, alkalies, chlorides, oils, brine, oxygen, gasoline and alcohol solutions, called Cotoid, has been developed by the Lithgor Corp., 333 West 40th Place, Chicago 9, Ill. This is a recently developed formula based on synthetic resin—a thermo-plastic—in which its low water absorption and inert properties are said to inhibit corrosion.

Its application is reported to provide a hard, elastic finish. It may be used for protecting walls, wood or steel structural work, the inside and outside surfaces of concrete, steel or wooden tanks used for corrosive solutions, brines and alkalies.

The coating is stated to withstand a maximum temperature in air or vapor of 220 deg. F., maximum submerged temperatures approaching 150 deg. F. It is stated not to crack under temperatures as low as 20 deg. below zero F.

Application by spraying is recommended. It can be applied by dipping, flowing or roller coating. A specially prepared formula for baking-on process is available.

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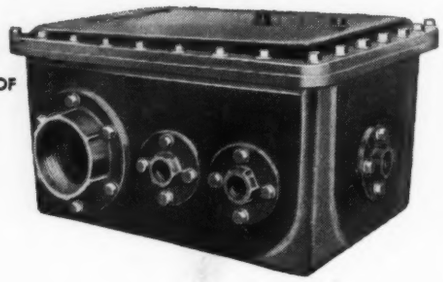
Spot, Arc, Gun and Push Gun Welder in Single Unit

No. 310-AA Universal Spot Welder, recently announced by the Eisler Engineering Co., 750 So. 13th St., Newark, 3, N. J., is reported especially suited for spot welding all types of sheet metal work. In addition, it is stated, the unit can be used with a hand-operated push-type and tong-type gun welder, and for a.c. arc welding (100-400 amp.). The gun welder is also made for air operation.

One of the features reported on this machine is the deep throat provided by both horns which can be lengthened or shortened by sliding them in the bearings and thereby fit the size and type of sheet metal work to be welded; a second is that



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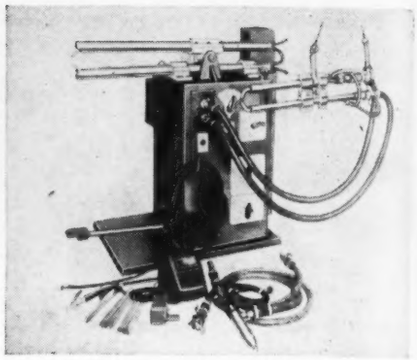


the horns are mounted on the top of the fabricated case and thus the machine is suitable for spot welding large sheet metal parts.

The machine is intended for deep sheet metal work of light gage, but will also weld heavier work in the short throat position. The rating of the welders range from 20 to 50 kva., at the shortest throat depth. The horns and the tip holder and tips are water cooled. The machine is available for air as well as foot operation. Wiring permits independent operation of spot welding and arc welding.

•

Turntable Expedites HF Heating Operations

AN AUTOMATIC TURNTABLE designed for brazing and soldering operations by induction heating is a recent development of Lepel High Frequency Laboratories, Inc., 39 West 60th St., New York 23, N. Y.

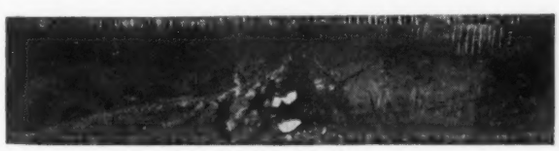
Assemblies which are to be heated are placed in "positions" on the table, which revolves at the selected speed to provide the desired heating cycle. Pieces are automatically ejected and counted after brazing. The operator can load a number of positions at one time.

By a change in revolving speed, the table can also be used for soft soldering, silver soldering, hardening, annealing, etc. The table is connected to the induction heating unit, as indicated in the illustration, to carry the high frequency current through the load leads to the specially designed inductor coil for the specific operation involved. The rotating mechanism may be used on a 110-volt, 60-cycle circuit.

HOW THE ANODIC POINTS WERE CAPTURED

In many cases where a condenser tube has proven unsatisfactory in a given application, analysis of conditions will show the cause of the failure to be outside the tube itself.

A Scovill engineer was requested to explain the puzzle of the consistent failure of tubes in the first pass of a marine condenser. 18 tubes had failed in this pass, as the result of intense local pitting.

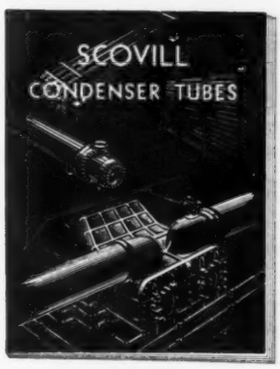


Deposits Had Done It — He found that the pitting was due to "deposit attack", an electrochemical type of corrosion initiated by foreign material lodged against the tube walls. Where such deposits covered the metal, those "islands" became anodic to the adjacent uncovered areas, with resultant intense corrosion of the anodic area. In this case, turbulence of the water passing around the deposit caused erosion-corrosion on downstream side of deposit.

Examination showed no evidence of any other type of corrosion.

The suggestion of the Scovill engineer which aided in the solution of the problem was to modify the circulating water inlet and to establish a regular practice of cleaning the tubes, using rubber plugs, bristle brushes or other equipment that would not score the tube walls.

Three Scovill Services — Scovill *Service in Men* provides specialized study and advice on individual tube application problems and on installation practices. *Service in Metals* includes production of many tube alloys, and also offers you the facilities of our laboratory to help determine the alloy best suited to your conditions. *Service in Manuals* provides valuable literature on condenser and heat exchanger tubes; for a free copy of our Condenser Tube Booklet, address Scovill Manufacturing Company, 24 Mill St., Waterbury 91, Conn.



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Service in Metals
Service in Men

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CONDENSER TUBES

NEWS ABOUT PEOPLE

Baltimore Utility Names Crane Executive Vice-President

Charles P. Crane, who has been vice-president of the Consolidated Gas Electric Light & Power Co. of Baltimore since 1938, was elected executive vice-president at the company's recent annual meeting. He succeeds William Schmidt, Jr., formerly executive vice-president, who was elected president of the company (ELECTRICAL WORLD, April 20, page 16).

C. P. CRANE

Mr. Crane began his service with Consolidated in 1910 when he was employed as secretary in the vice-president's office. He was promoted to assistant to vice-president in 1919, the position he held until his election as vice-president.

Prior to his association with Consolidated, Mr. Crane was connected with the Baltimore & Ohio Railroad Co. at the Baltimore office and later with the War Department in Washington.

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▶ JOHN E. DUGAN, long identified with the Pacific Northwest electrical industry as industrial service consultant for Puget Sound Power & Light Co. and previously with the Montana Power Co., has been appointed as commercial electric cooking specialist for the Bonneville Power Administration. Mr. Dugan has been active in the engineering and installation of many of the largest commercial cooking kitchens and bake shops in the Northwest in recent years, acting in an advisory capacity to architects, contractors and food service establishments. He received the Northwest Electric Light and Power Association 1941 award for outstanding work in the electric commercial cooking field.

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Virginia Utility Announces Engineering Appointments

The following changes have recently been announced by E. S. Fitz, general manager of the electric department of the Virginia Electric & Power Co.:

Roger S. Walke has returned from active duty in the U. S. Army and assumed the duties of district superintendent.

Robert C. Daffron, formerly acting district superintendent, has been appointed assistant district superintendent.

W. W. Archer, Jr., has been appointed superintendent of stations and substations, Richmond.

S. P. Woolford has been appointed district superintendent of the Albemarle district.

John T. Mason has been named assistant to the general manager of the electric department.

R. E. Kimball, formerly acting district superintendent of the Albemarle district, has been made district engineer of the same district.

A. L. Jameson, formerly assistant to the general manager of the electric department, has been transferred to the sales department as director of customer installations.

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▶ JAMES E. HUNT, formerly superintendent of generating stations, Philadelphia Electric Co., has been appointed administrative engineer, electric operations. Mr. Hunt has long been associated with the Philadelphia utility, having started in 1904. Through a succession of assigned duties, he was appointed superintendent of Schuylkill Station in 1917. He served in this position until 1925, when he was made superintendent of Richmond Station. It was in 1939 that he became superintendent of generating stations.

▶ LEIGHTON B. POTTER has been appointed utilization equipment and primary supply engineer, system engineering, Detroit Edison Co. Mr. Potter entered the employ of the company in 1928.

AEIC Elects Parker President at Meeting in Cincinnati

James W. Parker, president of the Detroit Edison Co., was elected president of the Association of Edison Illuminating Companies at the meeting held last week in Cincinnati.

Mr. Parker has been president of the Detroit utility since 1944. Starting with the company in 1910, he has been continuously in its service since then except for a year's duty with the War Department in 1918. For 20 years he was chief engineer, in 1935 was elected a vice-president and in 1943 vice-president and general manager. During his association with the company he has organized and directed various engineering projects, including design, construction and operation of power and heating plants.

J. W. PARKER

Mr. Parker is a past-president of the A.S.M.E. and of the Engineering Society of Detroit and is a member of Detroit and national engineering and industry committees.

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▶ DR. JOSEPH SLEPIAN, associate director of the Westinghouse Research Laboratories, has just received a French government decoration awarded in pre-war Paris in 1939, an "Officier d'Academie." One of six such awards made to Americans by the French Ministry of National Education, the certificate was sent through the American Embassy in Paris, via the State Department. The award followed a visit by Dr. Slepian to France in 1938, during

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The finished materials—available in sheet form, in rods or tubes, or molded or shaped into special forms—are used in motors and generators as slot sticks, armature or stator end laminations, as brush holders, spacer blocks, in dry-type transformers, etc. The low-electrical-loss properties of several types of Fiberglas-base laminates have led to their wide use for radio and electronic applications.

If the products you are designing or manufacturing require a material with high dielectric strength, dimensional stability, moisture and temperature resistance and/or adequate mechanical strength for high-frequency, low-electrical-loss parts—investigate Fiberglas-base laminates.

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which he lectured on scientific subjects and conferred with noted French scientists.

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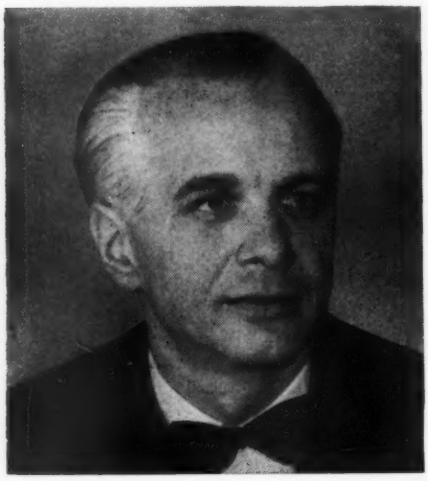
P. R. Mallory & Co. Elects Hensel Vice-President

Dr. F. R. Hensel has been elected vice-president in charge of engineering of P. R. Mallory & Co., Inc., Indianapolis, Ind.



F. R. HENSEL

Dr. Hensel has been chief metallurgical engineer for the Mallory company since 1934.

He is a member of the American Institute of Mining and Metallurgical Engineers, American Society for Testing Materials, American Society for Metals, American Welding Society, Society of Automotive Engineers, American Association for the Advancement of Science, and the British Institute of Metals. He has presented more than 40 technical papers before various scientific societies, and has been granted more than 140 patents on alloys and metallurgical processes.

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▶ GEORGE J. BRETT, controller of the Niagara Hudson Power Corp., has been elected a vice-president of the corporation. Mr. Brett began his utility career with predecessor companies of the Niagara Hudson System at Niagara Falls, N. Y. He was elected controller in 1941.

▶ LEWIS A. ROBERT, research engineer for the Stewart-Warner Corp., was awarded the Wetherill Medal by The Franklin Institute for "important and applied work in developing a thermal ice-prevention system for airplanes."

▶ THEODORE E. LIEBERT, formerly superintendent of production of Superior Carbon Products, Inc., Cleveland, has been appointed sales manager.

Schmit Made Vice-President of RCA Victor Division

Election of D. F. Schmit of Moorestown, N. J., as vice-president in charge of the engineering department of the RCA Victor Division, Radio Corp. of America, and Fred D. Wilson, Marlton, N. J., as vice-president in charge of the personnel department of the RCA Victor Division has been announced.

Mr. Schmit has held important engineering positions in the company for more than fifteen years. Joining RCA in 1930, he became manager of research and engineering in tube manufacture at Harrison, N. J. In 1939, he was named manager of the new products division, and four years later was appointed assistant chief engineer of the RCA Victor Division. He was promoted to director of engineering in 1945.

Mr. Wilson has been director of personnel of the RCA Victor Division since May, 1945. He joined the RCA organization in 1936.

W. W. Watts has been appointed general sales manager of the engineering products department of the Victor Division. Mr. Watts had served as a colonel in the Signal Corps for three and one-half years. Prior to his association with the Army, he was connected with Montgomery Ward & Co. and the Zenith Radio Corp.

D. F. SCHMIT

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▶ EDWARD A. HOLMBERG has been made manager of the appliance promotion bureau of Consolidated Edison Co. of New York, Inc. Mr. Holmberg takes the place of DENNIS S. MELVIN, who has been transferred to the purchasing department as the result of his selection for the company's executive development program. Mr. Holmberg, who has been with Consolidated Edison and its affiliates for 37 years, was assistant manager of the bureau before his promotion. Prior to 1937 he was in charge of appliance promotion for the Brooklyn Edison Co. Since then he has held supervisory positions in the sales department of the System Companies. HARRY A. SAMMOND, formerly associate district sales manager, has been named assistant manager of the appliance promotion bureau to replace Mr. Holmberg. Connected with Consolidated Edison for 19 years, Mr. Sammond has been in district sales work since 1937.

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Hotpoint Assigns Broader Duties to H. E. Kenitz

H. E. Kenitz has been appointed manager of manufacturing, Edison General Electric Appliance Co., Chicago. Mr. Kenitz has been with the company since 1925 as superintendent in the company's several plants and later, until the present, general superintendent.

H. E. KENITZ

He will have complete charge of all of the company's manufacturing operations.

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▶ ROY H. ELFSTROM has been appointed supervisor of industrial safety of the British Columbia Electric Railway Co. He will be responsible for all safety matters in the company's operations, exclusive of public safety. After taking a post-graduate course at Harvard University in industrial hygiene, Mr. Elfstrom entered the employ of the Federal Department of Health and Welfare in the industrial hygiene division. He acted as representative in the field, his territory covering British Columbia and Alberta. He has held this position for the past four years.

▶ D. PAUL AYERS, formerly division engineer of the Kansas Power & Light Co., Topeka, Kan., has joined the sales engineering staff of Copperweld Steel Co.,

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COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Condenser and Heat Exchanger Tubes

Wide Range of Corrosion-Resistant Alloys

The selection of the most economical and satisfactory condenser or heat exchanger tubes is a problem which every power plant engineer must answer from time to time. The frequency with which this matter comes up for consideration depends upon the size and the age of the plant, and the severity of the corrosive conditions. Our object is to present information, as briefly as possible, which will help the engineer in his selection of an alloy which will give the greatest satisfaction and longest life.

During the past thirty years the replacement of corroded condenser and heat exchanger tubes has become more complicated because of the many changes which have taken place during this period. Thirty years ago there were essentially only four commercial copper-base alloys to choose from—Copper, Muntz Metal, 70-30 Brass and Admiralty. Today there are at least a dozen different alloys.

Influence of Alloy Composition

Corrosion research data show that small additions of certain metals to copper base alloys have a very marked influence on the rate of corrosion from sea water, fresh water, brackish water and polluted water. Tin, aluminum, nickel, zinc, iron, arsenic, etc., alloyed with copper singly or in combination, have resulted in the development of superior alloys.

Factors Influencing Rate of Corrosion

In a number of instances, the replacement of worn-out, corroded condenser and heat exchanger tubes with tubing made from an alloy which had previously given many years of service, has not worked out as well as expected. There are many factors which may contribute towards this situation. We find that harbor waters are becoming more and more polluted by industrial wastes and sewage. Again, operating conditions in many instances are more severe—the condenser service hours per year have in many instances been increased considerably, sometimes approaching almost continual operation. Frequently, this has a very pronounced effect on the life of the tubes, depending upon the alloy and seasonal variation in the composition of cooling water or steam. Also, greater quantities of water at higher velocities may be forced through condensers either to raise their efficiency or, in some cases, to make possible their use when larger condensers are actually needed. The use of larger capacity pumps may increase waterflow and turbulence.

In cases where chlorination is successfully practiced on old tubes, it is found that chlorination used on new tubes sometimes prevents the formation of a tenacious protective corrosion film, and contributes to premature failure. When changes in operation are contemplated, it is well to consider their possible effect on tube life and select the alloy which will be the most satisfactory one for the new conditions.

Duronze IV—One of the finest condenser tube alloys. Excellent corrosion resistance to sea water, and polluted brackish water. Highly recommended for seaboard power plants.

Cupro-Nickel 70-30—Excellent corrosion resistance to sea water; resists impingement corrosion from high water velocities. Good resistance to stress corrosion and higher operating temperatures. Most resistant of this group of copper-base alloys to the action of ammonium hydroxide. U. S. Navy specifies this alloy for war ships and other vessels.

Cuzinal (aluminum brass)—Resists impingement corrosion from high velocity and trapped air bubbles in sea water.

Arsenical Admiralty—Good general corrosion resistance to sea water. Resists dezincification. Recommended for low water velocities only.

Red Brass—Excellent-to-good corrosion resistance to most inland fresh waters. Practically immune to dezincification.

Arsenical Muntz Metal—Good corrosion resistance to fresh waters. Contains arsenic as a dezincification inhibitor.

Arsenical Copper — Excellent-to-good corrosion resistance to most inland fresh waters.

For more complete information, technical data and the results of corrosion studies, write for 112-page Condenser Tube Manual. For assistance in selecting the most suitable condenser tube alloy, contact our Technical Service Department through your nearest Bridgeport office.

CONDENSER AND HEAT EXCHANGER TUBES

	Duronze IV	Cupro Nickel 70-30	Cuzinal	Arsenical Admiralty	Red Brass	Arsenical Muntz	Arsenical Copper
ANALYSIS							
Copper %	94.25	68.85	77.0	71.0	85.0	62.0	99.6
Aluminum %	5.5		2.0				
Tin %				1.0			
Zinc %			20.98	27.97	15.0	37.9	
Phosphorus %							0.02
Arsenic %	.25		.02	.03		0.1	0.3
Nickel %		30.00					
Iron %		.40					
Manganese %		.75					
MECHANICAL PROPERTIES							
Ten. Strength psi (Hard* / Soft)	60,000	60,000	60,000	53,000	44,000	56,000	40,000 / 32,000
Yld. Strength psi (@½% extens. under load) (Hard* / Soft)	22,000	25,000	27,000	22,000	18,000	23,000	
Elongation % in 2" (Hard* / Soft)	60	45	55	65	45	50	25
Rockwell Hardness (Hard* / Soft)	F78	F80	F77	F75	F71	F82	F77
PHYSICAL CONSTANTS							
Melting Pt. (Liq)°F	1940	2260	1780	1720	1880	1660	1981
Density, lbs./cu. in.	.295	.322	.301	.308	.316	.302	.323
Coeff. Therm. Exp. per °F from 77°F to 572°F x10⁻⁶	10.0	9.0	10.3	11.2	10.4	11.6	9.8
Thermal Conduct. Btu/sq ft/ft/hr/°F @ 68°F	46	17	58	64	92	71	112
Elec. Cond. % IACS @ 68°F Soft	17.0	4.6	23	25	37	28	45
Mod. of Elas. (Tension) psi.	17,500,000	22,000,000	16,000,000	16,000,000	17,000,000	15,000,000	17,000,000
FABRICATION PERFORMANCE							
Machinability Rating**	20	20	30	30	30	40	20
Cold Working	G	G	E	E	E	F	E
Hot Working	G	G	F	F	G	E	E
Hot Working Range °F		1700-1900	1400-1600	1200-1450	1450-1650	1150-1450	1400-1600
SPECIFICATIONS							
A.S.T.M.	B111-Al Bronze	B111-70-30 Cupro-Nickel	B111-Al Brass Type B	B111-Admiralty Type B	B111-Red Brass	B111-Muntz	B111, Arsenical Copper
Federal				WW-T-756			
Navy		44T39A 44T40Int.		44T7 Int.			
Army							
AMS							

* Hard temper—values are for temper suitable for condenser installation.
** Machinability rating—free cutting brass=100.
E—Excellent G—Good F—Fair P—Poor
All figures are nominal values and should not be used as specifications.

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Glassport, Pa. Mr. Ayers has a background of 18 years' practical experience in the design, construction, operation and maintenance of electrical transmission and distribution systems.

▶ WALTER M. REYNOLDS, information manager of the American Telephone & Telegraph Co. since 1944, has been appointed publications manager of Western Electric Co. Mr. Reynolds will report to F. B. Wright, director of public relations.

▶ WILLIAM S. MCCLINTIC has become a member of the staff of the National Electrical Manufacturers Association. Mr. McClintic has been assigned as recording secretary for floodlighting, large generator and converting apparatus, traffic signaling, overhead trolley line materials and industrial heating units and devices sections. He was released with the rank of commander after 52 months service with the Bureau of Aeronautics, Navy Department. He is a graduate of Massachusetts Institute of Technology and has had broad experience in outside plant and sales engineering for the New York Telephone Co. Prior to entering the service, he was chief physicist in charge of degaussing for the Eighth Naval District comprising the Gulf Coastal Ports.

▶ IRWIN A. ROSE, formerly vice-president in charge of manufacturing for the Edison General Electric Appliance Co., a subsidiary of the General Electric Co., has been elected to the same position with the Maytag Co. Mr. Rose succeeds A. H. TAYLOR, resigned.

▶ TYE M. LETT, JR., has been appointed director of exports of the Crosley Corp. Mr. Lett has been assistant export director since last July when he joined the Crosley organization. He succeeds J. W. DeLind, Jr., resigned. Mr. Lett has been an exporter for many years.

▶ GORDON M. COLWILL has been appointed supply sales manager for the Graybar Electric Co. at executive headquarters in the Graybar Building, New York. He is the former manager of the supply department in the company's Detroit territory. WILLIAM J. GOERISCH has been made lamp department sales manager at executive headquarters. Mr. Goerisch began his Graybar career at St. Louis in 1929 as power apparatus department manager and two years later was assigned in addition the managership of the lamp and lighting department. In 1941 he relinquished his power apparatus department responsibilities to devote his entire attention to supervising the sale of lamps and lighting equipment.

Philipp Made Vice-President of Nash-Kelvinator Corp.

Dr. L. A. Philipp, chief engineer, Kelvinator Division, Nash-Kelvinator Corp., Detroit, has been elected vice-president of the corporation in charge of engineering, Kelvinator Division.

Dr. Philipp joined Kelvinator in 1927 as director of research, after lengthy research fellowships at the University of California and the University of Michigan. He became manager of the Detroit plant of Nash-Kelvinator in 1937, and two years later became chief engineer of Kelvinator.

L. A. PHILIPP

Recognized as one of the outstanding men in technical research, he has participated in many important refrigeration and appliance developments and holds numerous refrigeration patents. Mr. Philipp was recently commended for his war services at Nash-Kelvinator by the Air Technical Service Command.

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▶ THEODORE BRAATEN has been appointed general manager of the Gas & Electric Department of Norwich, Conn., succeeding Leland D. Wood. Mr. Braaten was graduated from the Massachusetts Institute of Technology in 1920. After teaching there for a year, he spent a year in Norway investigating hydroelectric facilities as a fellow of the American-Scandinavian Foundation. For three years he was connected with the Public Service Co. of Northern Illinois in the operating department, then joined the Westinghouse organization at East Pittsburgh, becoming switchboard engineer and later being attached to the Boston office as switchgear specialist and then central station engineer. From 1937 to 1942 he was in the station electrical design division of the Boston Edison Co., becoming assistant head. In World War I he was a lieutenant of field artillery overseas. He entered the U. S. Army as a captain in 1942 and early this year was honorably discharged with the rank of lieutenant-colonel. In the European Theater of Operations he was under immediate SHAEF direction and responsible for public utility service restoration for army needs in various major districts and combat areas in Holland and Germany, including Aachen and Berlin, followed by designation as chief of public utilities, SHAEF Mission, Norway.

OBITUARY

▶ STEUART PURCELL, chairman of the Maryland Public Service Commission, died on April 18 in Baltimore, Md., after an illness of two weeks. He was 68 years old. A native of Dublin, Ireland, Mr. Purcell was brought to this country at an early age and received his engineering education at Cornell University. He entered the employ of the City of Baltimore in 1910 and after service in World War I, he returned to municipal employ as highways engineer and later as chief engineer of Baltimore. Mr. Purcell joined the Maryland commission in 1927 and had been chairman since 1941.

▶ E. T. HOLLINGSWORTH, veteran Ohio Power Co. employee, who retired in 1941 after 34 years of service, died on April 11 in Canton, Ohio, at the age of 77. One of the oldest employees of the American Gas & Electric Co., after joining the Ohio Power Co., an American Gas & Electric subsidiary, Mr. Hollingsworth was employed at Lancaster, Newark and Mt. Vernon before going to Canton in 1921 as commercial manager.

▶ THEODORE VANDEVENTER, an associate of Thomas A. Edison and one of the pioneers to go to Schenectady with the famous inventor when his electrical works were established there, died on April 15 after an illness of two years. He was 85 years old. A native of New Brunswick, N. J., and a graduate of Rutgers College, he became associated with Mr. Edison in 1883 at the Edison Machine Works in New York City, going to Schenectady in 1886 when Edison moved his plant there. When the General Electric Co. was organized in 1892, it absorbed the Edison plant. Mr. Vandeventer remained with the consolidated company until 1930, when he retired, more than 47 years after joining Edison in New York.

▶ ARTHUR G. SIAS, 71, manager of the Reading (Mass.) municipal electric light department, and for the past 33 years connected with that utility, died suddenly in Reading on April 14. He was a

native of Boxford, Mass., and a past-president of the Municipal Lighting Association of Massachusetts.

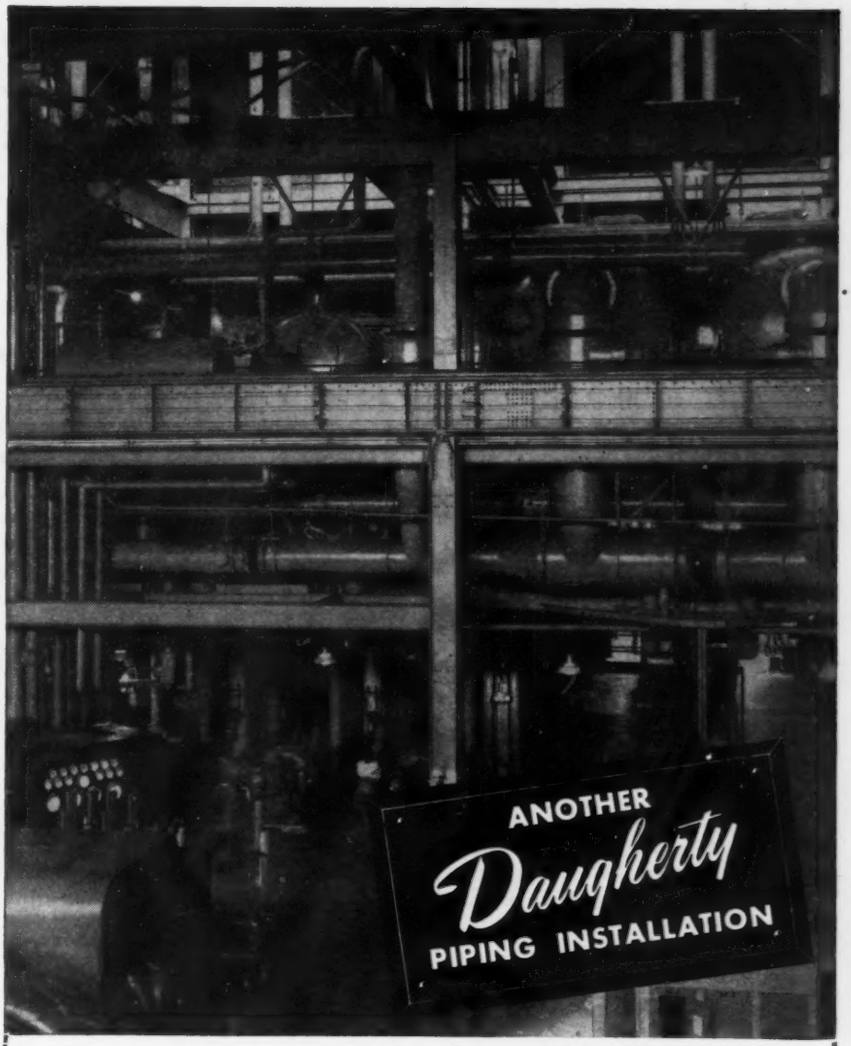
▶ CHARLES K. WILLIAMS, factory superintendent and engineer in charge of inspection and testing for the Reliance Electric & Engineering Co., died at his home in Cleveland, Ohio, on April 4. Mr. Williams was a native of Waterloo, Ind., and a graduate of Case School of Applied Science.

▶ BYRON W. ST. CLAIR, 54, president and treasurer of the Mico Instrument Co., Cambridge, Mass., died at the Cambridge Hospital on April 4. He was identified with extended electrical development work in the measurements field for both peace-time and military applications, and was formerly associated with the General Electric Co.'s meter department in West Lynn, Mass.

▶ FREDERICK HOFFMEISTER, retired erecting engineer of the Canadian General Electric Co., and prominent in the electrical field in Canada for many years, died on April 13 at Niagara Falls, Ontario. Mr. Hoffmeister installed the generators at the Ontario Power Co. plant at the Falls and the hydro powerhouse at Queenston, Ont., for the Canadian General Electric Co. He also installed the power house at the Beauharnois power plant in Quebec. He was at one time general superintendent of the British Columbia Electric Railway Co. Other electrical work in which Mr. Hoffmeister engaged was as resident engineer for installation of the electrical plant for operation of the Soulanges Canal and the remodeling of the Halifax Electric Tramway plant and the Saint John railway power plant.

▶ HENRY H. FITHIAN, electrical engineer, who was chief expediter during the recent war in the construction of the Badger, Sunflower & Radford ordnance works, all projects of the Hercules Powder Co., died at Doctor's Clinic in Philadelphia on March 14. He was 57 years of age. A graduate of Lehigh University, Mr. Fithian served as an apprentice with the Westinghouse Electric Corp. and subsequently became a consulting engineer for the company. As an engineer for the Hercules Powder Co. at Wilmington, he was also instrumental in successfully forwarding the penicillin and DDT manufacturing facilities constructed under their supervision.

▶ JAMES A. AHEARN, 77, formerly general manager of the Cambridge (Mass.) factory of the Worthington Pump & Machinery Corp., died at Belmont, Mass., on April 5. He held this position from 1915 to 1929.



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MANUFACTURERS & MARKETS

Newer Light Sources Used in Post-War Home

Slimline and Circline Employed with Conventional Sources to Provide Light in New Home

The newer light sources—Slimline and Circline—as well as the more familiar standard fluorescent lamps and self-contained reflector type incandescent lamps were used in lighting the new post-war home recently opened for inspection by the research division of Fritz B. Burns Housing Projects in Los Angeles, Calif. Light for seeing as well as for decorative purposes was provided by Westinghouse units and dramatized the residential usages for the newer light sources.

Reflector-type incandescent lamps of 150 watts, flush-mounted in ceilings, provide much more than usual illumination in hallways, highlight salient areas in rooms, and illuminate covered outside areas. Standard 40-watt fluorescent lamps controlled by door-operated switches light closets and cupboards. Others help to provide general or supplementary illumination in bathrooms, the house "office" in the kitchen, and elsewhere.

Three 72-in., 22-watt Slimline fluorescent lamps provide a curtain of light behind a built-in valance over the front windows in the spacious living room. On either side of the fireplace on the east wall and topping radio and television sets located there, are two 42-in., 15 watt Slimline lamps. Three flush-with-the-ceiling 150-watt self-contained reflector type incandescent lamps are also located in the living room, to highlight tables and other furniture.

An interesting lighting innovation in the main bathroom is a 32-watt Circline fluorescent lamp built behind the shaving and make-up mirror in a special fixture devised by Joseph H. Shulte, research director for the Burns Co. This circular lamp is entirely concealed behind the outer circumference of a convex mirror. Its rays are reflected onto the face by a special silvered fixture which fits flush with the bathroom wall. Two 40-watt standard fluorescent lamps are mounted vertically in corners on the east wall.

Circline lamps have been incorporated in special table lamps in the master bedroom. The circular fluorescent lamps are used with supplementing incandescent lamps.

Incandescent bulbs and fluorescent tubing provide general and in-the-cupboard lighting in the kitchen. The former are 150-watt self-contained reflector type bulbs similar to those used elsewhere in the house, and are flush-mounted in the ceiling to highlight salient working areas. A 40-watt standard fluorescent tube provides supplementary illumination over the desk—the house "office"—in the kitchen.

An unusual decorative effect is provided by an installation of two 32-watt Circline lamps in lattice work over the barbecue pit in the garden. An ingenious housing arrangement protects the lamps from the weather.

Also in the spacious gardens, weather-protected incandescent flood- and spotlights illuminate specimen trees and flower beds, pools and benches.

LIGHT FOR FUN—Illumination of the barbecue and fun center is provided by two 32-watt circline fluorescent lamps mounted in the reflectors in the pergola. Two 20-watt tubular fluorescent lamps provide supplementary lighting over the sink and the work table adjoining the charcoal broiler. The units are provided with a housing arrangement as a protection against the weather. The equipment installed in this barbecue makes it almost completely independent of the kitchen

•

Moves to Larger Quarters

Allen-Bradley Co., Milwaukee, Wis., has announced that its Boston office has been moved to larger quarters at 55 Oliver St. The new location combines warehouse and office facilities.

Centennial Forum Honors George Westinghouse

Leaders of thought in every field—both in this country and abroad—were recently extended invitations to attend the George Westinghouse Centennial Forum in Pittsburgh, May 16, 17 and 18, at which world-renowned scientists, educators and industrialists will exchange views on "Science And Life In the World."

M. W. Smith, Chairman of the Westinghouse Educational Foundation, which is sponsoring the three-day Forum in observance of the 100th anniversary of the birth of the founder of the company, announced 3,000 invitations were mailed out to persons in this country. Another 100 were sent to foreign countries.

Among the prominent speakers to address the Forum will be Dr. Archibald V. Hill, foreign secretary, Royal Society, England; Dr. Isaiah Bowman, president of Johns Hopkins University; Dr. J. Robert Oppenheimer, professor of physics, University of California, now special consultant, Department of State; Charles F. Kettering, vice-president in charge of research, General Motors Corp.; Dr Vannevar Bush, director of the Office of Scientific Research and Development; Dr. Frank B. Jewett, president, National

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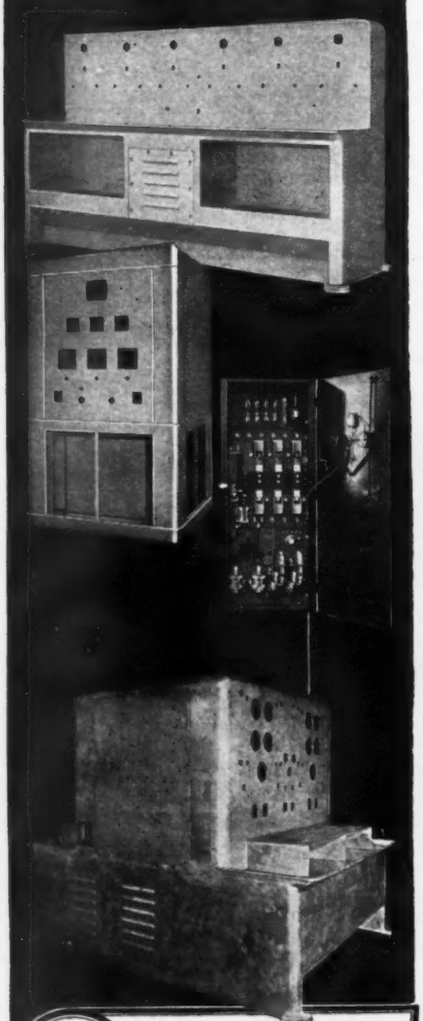

LITTLEFORD

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Cincinnati, 2, Ohio.

Academy of Sciences; Martin W. Clement, president of the Pennsylvania Railroad; and Dr. Solman A. Wakeman, professor of microbiology, Rutgers University.

Among the 361 patents granted to George Westinghouse were those covering the early apparatus on the alternating current system of generation and transmission, electric locomotives, railway signaling devices and the air brake.

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Television Program Shown on Theatre Screen

First Time Microwave Relay Equipment Used in Feeding Signals to 11- x 15-Ft. Screen

Experimental electronic equipment which revealed future possibilities for nationwide distribution and projection of theatre television was demonstrated in Schenectady recently to 50 General Electric officials and motion picture representatives at a private 30-min. show involving facilities of the company's television station WRGB and the Civic Playhouse.

G. E. engineers used microwave radio relay equipment to send the program from the WRGB studio to the Playhouse, where it was flashed on an 11- x 15-ft. screen by a special television projector provided by the Rauland Corp. of Chicago.

The program consisted of special films provided by 20th Century Fox Film Corp. and a live talent show produced by the WRGB staff.

As the WRGB cameras "viewed" the various performances, the scenes were fed by way of coaxial cable to a special low-power microwave FM transmitter located on a tower adjacent to the studio. The transmitter output was then beamed by a directional transmitting antenna toward the Playhouse. Here another directional antenna picked up the microwave transmissions and supplied energy by way of coaxial cable to a special FM picture receiver. This unit fed the picture signals to the Rauland television projector which flashed them on the screen. The sound was also transmitted from the WRGB studios to the Playhouse by means of a radio link.

This was the first time microwave relay equipment has been used to feed television signals to a theatre for large-screen projection.

General Electric officials and Mr. Rauland stated that the demonstration was part of a broad program of research and engineering being carried on by both companies in the television field at the present time.

The television projector equipment employs present commercial techniques, according to Dr. C. S. Szegho of the Rauland Corp., who explained that new methods now under intensive development promised significant improvements in this field.

The microwave relay equipment used in the demonstration was part of the apparatus G. E. engineers have developed for an experimental radio relay network to connect Schenectady and New York City in a two-way operation. This network is being designed to carry simultaneously many electronic services. Such services as television, FM radio and facsimile are included.

TELEVISION SCREEN SIZE—Experimental showing of a television program on a theatre screen used microwave radio relay equipment and a Rauland projector. Demonstration was given at Schenectady

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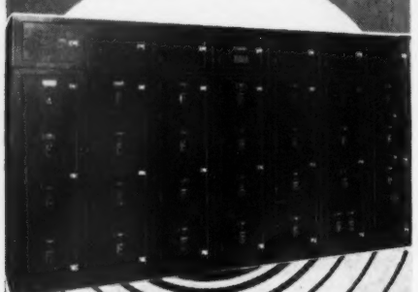

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FIELD REPORTS ON BUSINESS

Authorization for additions to electrical manufacturing plants with priority rights lends encouragement to the electrical market, but material shortages still restrict production. Rural electrification is being retarded by lack of meters, transformers, wire and insulators. The electric appliance situation remains unchanged.

NEW ENGLAND

Authorizations to permit immediate construction with priority rights numbering among them additions to electrical manufacturing plants lend on encouraging picture to the electrical market in this area, but shortages of critical materials continue to plague production and construction engineers. Rural electrification extensions in New England are being retarded on private company lines by lack of meters, transformers, wire, and insulators.

Of more than $5,000,000 authorized during the past week with priority rights, there are noted an addition to General Electric's transportation plant at Lynn, Mass., to take care of increasing demands, an installation of air-filtering equipment at the North Station, Boston, estimated to cost $25,500, and an air-conditioning system estimated at $65,000 for Cherry-Webb Co., Fall River, Mass. Warren Telechron Co., Ashland, Mass., will equip a plant at Worcester, Mass., and employ 500 workers with an increase in the annual payroll of more than a million dollars.

Massachusetts Department of Public Works has asked for bids to install refrigerating apparatus at the Gloucester (Mass.) Fish Pier; three motors totalling 450 hp. and compressor capacity of approximately 360 tons of refrigeration, together with a 1200 gpm. salt water pumping unit and panel control boards, will be required.

March building in New England took great strides ahead, gaining over 540 percent in permits for new construction over March, 1945, and more than 1000 percent in cost volume. There is little change in the electrical appliance field, although a little improvement is noted in the availability of vacuum cleaners, toasters, and mixers.

PACIFIC COAST

The total value for March of building permits in the seven western states was $140,000,989 or nearly twice that of the previous month, and nearly eight times that of March, 1945. California furnished $115,000,000 of the above total.

While many subdivisions and some public work were undoubtedly filed just prior to the recent building restrictions, and cover long-deferred construction, they are an indication not only of the building backlog, but also of what may be expected month by month. However, material is lagging far behind the demand, and wholesalers' back orders disclose figures that would be staggering if they could be supplied within the next few months. Electrical men throughout the West are hopeful that the new package mortgage, now being vigorously promoted by the banking chains, will help offset the high cost of labor and lumber, and will not only enable intending purchasers to insist upon a better electrical installation than the average speculative builder is able or willing to build but will also include a nice assortment of major electrical appliances and their requisite wiring.

A new trend in the industrial picture is the number of major research laboratories being located adjacent to western sources of raw material, the latest being Shell Development Co.'s $3,500,000 group of laboratories at Emeryville.

Plans have been recently announced for new plants of varied nature. Marchant Calculating Machine Co., an exceedingly large consumer of fractional horsepower motors, is planning $1,500,000 expansion of its Emeryville plant.

NEW YORK

The industrial production situation shows little change with such factors as strikes and material shortages still restricting output in some fields. Back orders in the steel industries are approaching peak levels as a result of the coal strike.

Civil engineering construction volume in continental United States totaled $154,743,000 for the week ending April 18, 1946, as reported to *Engineering News-Record*. This is the highest since the November 12, 1942, weekly volume which reached $304,000,000. This volume is also 30 percent above the previous week and 598 percent above the corresponding week of last year.

Sales of department stores in the Metropolitan area last week increased 49 percent over the comparative period of last year, the booming Easter trade being the outstanding feature of business in New York City.

CHICAGO

Large inter-city bus companies in this area, including Greyhound, are currently installing two-way radio communications systems to permit contact among buses and between buses and stations. Although the stand-by drain of the station receivers and transmitters is small, the operating current consumption is very high. Farnsworth Television & Radio Corp., Fort Wayne, Ind., plans to specialize in two-way communication systems for railroad systems.

Commonwealth Edison group of utilities expects to recover the 20-25 percent decline in industrial power which occurred after V-J day. In addition, rural electrification will mean a significant gain in power load for the firms, since the average farm customer uses 130 percent more power annually than an urban residential consumer. The group plans a $35.000.000 expansion program, or twice the 1945 figure, chiefly for utility plant additions.

Average payments per week for unemployment compensation by public utilities in January this year showed a 51.9 percent increase over December, or more than 36.9 percent for all industries. At the same time, however, the most important gains in employment during the period December 15-January 15 were shown in the electrical machinery and apparatus manufacturing field.

Building for March in the Chicago metropolitan region totaled $47,189,139, or the highest on record since September, 1942, when war building was at its height. In addition to the March total is the announced expenditure of close to $1,000,000 by the Chicago Housing Authority for 502 temporary dwellings for veterans.

Westinghouse, G.E. Up Pay of Non-Union Employees

Westinghouse Electric Corp. has announced pay increases for about 7,000 salaried employees not covered by any bargaining unit and for about 3,200 additional supervisory employees. W. G. Marshall, vice-president in charge of industrial relations for the company, strike-bound since January 15, said earnings of all non-supervisory employees not in bargaining units and working a forty-hour week would be increased $7 a week for those paid weekly and $30.30 a month for those paid monthly. Smaller increases will be given those working less than forty hours a week. Pay rises for the 3,200 other workers will be announced by local managements, Mr. Marshall asserted.

The company and the Federation of Westinghouse Independent Salaried Unions signed a new contract embodying the wage increase.

Charles E. Wilson, president of General Electric Co., announced that salaried employees who are not represented by bargaining units have been granted an increase which will raise their weekly salary rate by $7.40 over what it was on December 31. Mr. Wilson also revealed that the National Wage Stabilization Board has approved this increase and the 18.5 cents per hour wage offer agreed upon by the company and the United Electrical, Radio and Machine Workers of America, CIO. This increase will soon go into pay envelopes, retroactive to March 18.

The total raise since December 31 for salaried workers not represented by a union is now equivalent to 18.5 cents per hour. It was explained that salaried workers affected are those making less than $5,000 annually.

Mr. Wilson stated that the company and some unions not affiliated with the UERMWA (CIO) are now in the process of applying the 18.5 cents per hour increase to their members, subject to the prior approval of the National Wage Stabilization Board.

Allis-Chalmers Pay Increase Approved by U. S. Board

Wage Stabilization Board has approved for pricing purposes wage increases averaging 13½ cents to 14 cents an hour for about 10,000 Allis-Chalmers Manufacturing Co. workers in 30 states. Excluded were 20,000 production workers either on strike or negotiating adjustments with the company.

WSB unanimously approved a $15 to $25 a month increase, averaging 14 cents an hour for 8,900 office workers and employees not represented by bargaining agents.

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SALES OPPORTUNITIES

FLORIDA—Electric Department, Jacksonville, plans extensions and improvements in steam-electric generating station on Talleyrand Ave., including installation of additional equipment. Cost estimated close to $240,000. Financing in part has been arranged through federal aid and work is scheduled to be carried out soon.

OHIO—American Envelope Co., West Carrollton, has plans nearing completion for new addition to paper-converting plant, comprising a one and multi-story building, with machinery and electrical equipment. Cost reported over $1,500,000.

ARIZONA—Bureau of Reclamation, Denver, Colo., will receive bids until May 16 for three horizontal-shaft, multi-stage pumping units, each with capacity of not less than 1,000 gal. per min., under head of 1,100 ft., for water supply system for Boulder City, Boulder Canyon project, Arizona-California-Nevada. Equipment will be installed by government (Specifications 1293).

VIRGINIA—E. I. duPont deNemours & Co., duPont Bldg., Wilmington, Del., has authorized plans for new plant at Bellwood. It will be used for manufacture of sulfuric acid and will be operated by Grasselli Chemical Division of company. Project will comprise several one and multi-story buildings, with machinery and electrical equipment for large capacity. Also power house, power substation, pumping station and other utility structures. Entire project will represent investment of about $1,500,000, and is scheduled to begin at early date.

FLORIDA—Town Council, Lake Worth, is considering plans and estimates of cost submitted by Burns & McDonnell Engineering Co., 107 West Linwood Blvd., Kansas City, Mo., consulting engineer, for extensions and improvements in municipal power plant and waterworks system, including installation of additional equipment. Proposed to ask bids soon.

MINNESOTA—U. S. Engineer Office, Post Office and Custom House, St. Paul, plans early call for bids, to close on or about May 20 for new central control station at lock and dam No. 2, Mississippi River, near Hastings, as per plans and specifications on file.

MASSACHUSETTS—American Sugar Refining Co., Inc., 120 Wall St., New York, N. Y., has preliminary plans under way for new sugar refinery and syrup plant at Boston, to be operated in conjunction with present refinery on Granite St. It will consist of a number of one and multi-story processing and production buildings, with machinery and electrical equipment for large capacity. A power house is planned. Entire program is estimated to cost about $10,000,000. No date for actual construction has been determined, it is understood, this being dependent on availability of materials and equipment. J. F. Abbott is president.

WYOMING—Bureau of Reclamation, Denver, Colo., will receive bids until May 15 for three 2,000-kva., single-phase, oil-immersed, self-cooled, outdoor-type transformers, with lightning arresters; six single pole, outdoor distribution-type lightning arresters; three 69,990-volt, three-pole, single-throw outdoor-type power circuit breakers; one 34,500-volt similar type circuit breaker; nine 69,000-volt, three-pole, single-throw, manually gang-operated outdoor-type disconnecting switches; seven 34,500-volt similar type disconnecting switches; three 34,500-volt, single-phase, oil-immersed, self-cooled, outdoor-type potential transformers, all for installation in switchyard at Heart Mountain station; three 2,000-kva., single-phase, oil-immersed, self-cooled, outdoor-type transformers, with lightning arresters; one 15-kva., 33,000-volt, oil-immersed, self-cooled, outdoor-type distribution transformer; one 69,000-volt, three-pole, single throw, outdoor-type power circuit breaker; four 69,000-volt, single-throw manually gang-operated outdoor-type disconnecting switches; nine 34,500-volt similar type disconnecting switches, all for installation in power substation at Garland, Shoshone project, Wyo. Equipment will be installed by government (Specifications 1247).

OKLAHOMA—Town Council, Altus, plans expansion and improvements in municipal power plant, including construction of addition to present building and installation of two new generating units and auxiliary equipment. Entire program is estimated to cost close to $600,000, of which approximately $100,000 will be expended for building extension and remainder for required equipment.

NORTH CAROLINA—Waldensian Hosiery Mills, Inc., and Pilot Full Fashion Mills, Inc., both Valdese, affiliated companies, have authorized an expansion and improvement program at knitting mills. Work will comprise several additional buildings, with installation of machinery and electrical equipment for increased output. Project will be carried out over period of number of months and is estimated to cost about $1,500,000.

TEXAS—City Council, San Angelo, is considering installation of ornamental lighting system in downtown area. Estimates of cost will be made soon. J. P. Burden, San Angelo, is engineer.

COLORADO—Bureau of Reclamation, Denver, will receive bids until May 15 (postponed from April 15) for transformers, voltage regulators, power circuit breakers, switching equipment, lightning arresters, metering and relay equipment for Sterling and Holyoke power substations, Colorado-Big Thompson project (Specifications 1215).

OHIO—Standard Oil Co. of Ohio, Midland Bldg., Cleveland, plans new central laboratory and research station at Warrenville Heights, near Cleveland, where tract of about 80 acres of land has been purchased. It will consist of a group of one and multi-story buildings, with equipment and electrical apparatus for large working force. Cost reported over $1,500,000. Proposed to carry out project soon.

OKLAHOMA—Town Council, Tonkawa, plans extensions in municipal power station, with installation of equipment for increased capacity. Also will make additions and improvements in electrical distribution system. Entire program is estimated to cost close to $100,000. H. R. Hunter, 105 West English St., Wichita, Kan., is consulting engineer.

THE COLUMBIA SYSTEM in 1945

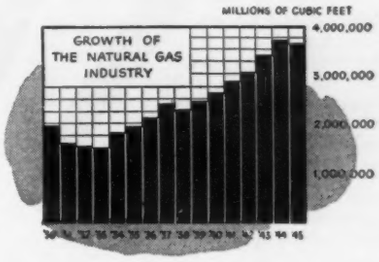
From The Annual Report of Columbia Gas & Electric Corporation

During 1945, the Columbia System passed from concentration on providing fuel for the furnaces of war to operations involved in the economy of peace. This changeover is being accomplished with little effect on public service operations or on the gross revenue of the System.

The Columbia System is comprised of Columbia Gas & Electric Corporation (The Parent Company) and 33 subsidiaries engaged in production, transmission and distribution of natural gas and electric energy. The System serves nearly 1,750,000 customers in 1,746 communities in Indiana, Kentucky, Maryland, New York, Ohio, Pennsylvania, Virginia and West Virginia.

Gas through 32,629 miles of field, transmission and distribution pipelines. Columbia served 1,278,213 customers with more than 179 billion cubic feet of gas. Industry depends heavily on this efficient fuel. Industrial customers, 3,179 of them, used more than 58 billion cubic feet in 1945. Columbia served 1,182,601 homes.

Electricity served to 447,139 customers, providing them with more than 2,628,000,000 kilowatt hours of electric energy over 16,529 miles of circuit lines. Industry, heavily dependent upon electric power, used more than 1,442,000,000 kwh, while 390,098 homes were supplied with nearly 444,000,000 kwh for light and power.



The use of natural gas, the favored fuel, has steadily increased. Last year, it is estimated that 3,700 billion cubic feet were produced by the entire natural gas industry. Reflecting this growth, Columbia System's gross revenues, 64% of which comes from gas sales, have risen from approximately 95 millions in 1936 to 138 millions in 1945.

Page 29

COLUMBIA GAS & ELECTRIC CORPORATION AND SUBSIDIARY COMPANIES

COMPARATIVE CONSOLIDATED INCOME STATEMENT

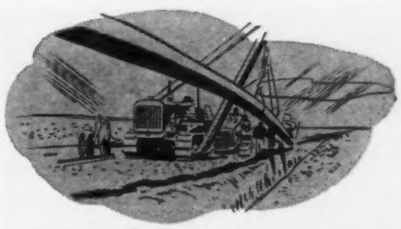
For the Year Ended December 31

SUBSIDIARY COMPANIES	1945	1944
Gross Revenues:		
Gas (Page 42)	$ 87,967,813	$ 84,915,604
Electric (Page 42)	41,760,253	42,754,527
Railway and Bus	.....	2,086,895
Oil and Gasoline	6,174,286	6,536,095
Water, Steam and Other Operations	1,791,957	1,536,754
Other Income (Interest, Dividends and Miscellaneous)	194,344	246,421
Total Gross Revenues	$137,888,653	$138,076,296
Operating Expenses:		
Operation—		
Purchased Gas	$ 22,771,686	$ 18,100,744
Production of Gas, Electricity, Oil, Gasoline, etc.	14,054,478	14,241,316
Rents and Royalties	4,150,425	4,416,719
General and Administrative, Customers Accounting and Collecting	13,818,339	13,065,876
and Sales Promotion Expenses	9,452,059	9,411,624
Transmission, Distribution and Other Operating Expenses	$ 64,246,987	$ 59,236,279
Total Operation	7,251,320	7,304,529
Maintenance	13,078,903	15,549,271
Provision for Depreciation and Depletion (Note 3)	9,898,160	10,224,935
Taxes (Note a)—	7,991,596	8,450,795
Other Than Federal Income and Excess Profits Taxes	6,896,958	12,070,606
Provision for Federal Income Tax	$109,363,924	$112,836,415
Provision for Federal Excess Profits Tax	$ 28,524,729	$ 25,239,881
Total Operating Expenses		
Gross Income Before Deducting Special Charge in 1945 (Note a)	$ 2,481,274	$ .....
*Income Deductions Including Special Charge in 1945—	3,107,712	3,112,049
Special Charge (Note a)	101,834	71,120
Interest and Other Fixed Charges	2,220,011	2,450,012
Less—Interest Capitalized	5,966	6,874
Preferred Dividends	$ 7,713,129	$ 5,497,815
Earnings Applicable to Minority Interests	$ 20,811,600	$ 19,742,066
Total Income Deductions		
Balance Applicable to Corporation	1,687,279	2,056,305
COLUMBIA GAS & ELECTRIC CORPORATION	$ 19,124,321	$ 17,685,761
Administrative and Other Expenses and Taxes Less Miscellaneous Revenue	3,656,619	3,976,036
Balance Before Fixed Charges	$ 15,467,702	$ 13,709,725
Interest and Other Fixed Charges		
Consolidated Net Income	$ 6,453,640	$ 6,453,640
Preferred Dividends Paid	$ 9,014,062	$ 7,256,085
Balance	74¢	59¢
Consolidated Earnings per Share of Common Stock Outstanding		

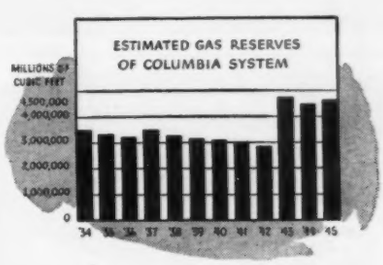
Note (a).

Federal taxes on income have been reduced resulting from the deduction for tax purposes of costs applicable to refinancing of bonds of subsidiary companies. An amount equivalent to this reduction is shown as a special charge in income deductions. The special charge and the reduction of taxes are both non-recurring items.

The attached notes are an integral part of the above statements.



Gas from the Southwest comes to the Columbia System through 2,400 miles of pipelines owned by others. This supply augments production from Columbia's 9,603 wells in the Appalachian area. In the last 10 years, to maintain the efficiency of Columbia's service, $176,600,000 has been spent on the construction and improvement of properties.



Gas reserves. The Columbia System last year withdrew only 4.6% of its estimated proven and unproven gas reserves. Available to the System from its own wells and from the vast Southwestern fields are reserves estimated at 4,500 billion cubic feet—assurance of service to the public for many years to come.

* * *

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Recent Rate Changes

ALABAMA POWER CO. has filed with the state Public Service Commission a petition to revise and lower its street lighting rates to all of one hundred fifty-three municipalities to which it supplies street lighting service. Should the commission approve the rate, these municipalities will not only receive a reduction in their bills for street lighting service, but will also receive 34 percent more lighting, the company has announced. The proposed new rates would save these municipalities approximately $23,000 a year in annual cost of their street lighting. The new rate will apply uniformly to all municipalities when new five-year contracts for the improved lighting service are made. The schedule also carries a low rate for lighting state highways at such points where traffic bottlenecks result in numerous night traffic accidents. "There is little question," said Thomas W. Martin, president of Alabama Power, "that well lighted thoroughfares reduce accidents and conserve lives and property. Public officials are taking a greater interest than ever in better street and highway lighting, and Alabama Power Co. wants to help in this important work."

ARKANSAS-MISSOURI POWER CORP. has informed the state Public Service Commission that it will make immediately a rate reduction of $175,000, which is about 9 percent of the monthly bill. Chairman Charles Wine of the commission said that Arkansas-Missouri had also ageed to set up a special fund, to be operated on a sliding scale, providing for a refund to customers of portions of earnings above 6 percent on the company's investment.

SAVANNAH ELECTRIC & POWER CO. has announced details of the new rate cut (ELECTRICAL WORLD, March 2, page 150), which was put into effect on April 1. Service for residential lighting, cooking, heating, refrigeration, and other small residential power through one meter include first 20 kw.-hr. or less $1; next 80 kw.-hr. at 3.60 cents per kilowatt-hour; next 100 kw.-hr. at 2 cents per kilowatt-hour and over 200 at 1.50 cents per kilowatt-hour. The same rate plus 25 percent will apply where service is rendered for less than one year, provided no customer billed will pay a minimum bill for any month in which no current is consumed. For residential or commercial water heating service applied through a separate meter, the company has the right to approve design and construction of the heater, wattage, voltage and thermostatic control of the units. The rates are 2 cents per kilowatt-hour for the first 30 and 1 cent thereafter, with a minimum of $1. The new commercial rates include, for alternating current only, $1 minimum up to 20 kw.-hr., 4.5 cents per kw.-hr. for next 280; 4 cents per kilowatt-hour for the next 700 kw.-hr., 3 cents per kilowatt-hour for the next 1500 kw.-hr., 2 cents per kilowatt-hour for the next 1500 kw.-hr., and 1.5 cents per kilowatt-hour for all over 4,000 kw.-hr. There is a charge of 50 cents per month per horsepower with minimum of $1. New seasonal rates for residential customers at Savannah Beach have been put into effect as well as ones for commercial seasonal customers.

ADAMS ELECTRIC LIGHT CO., which serves a number of communities in Jefferson County, New York, will reduce its rates to residential and commercial customers by an estimated $13,000 annually, effective May 1. The principal benefit to customers from the rate revision will be an increase of two kilowatt-hours allowed in the monthly minimum charge, from the present 13 to 15 kw.-hr. under the new tariff. The minimum monthly charge will remain unchanged at $1 per month. Under the new schedules, the rates will be made uniform throughout the company's territory.

VIRGINIA ELECTRIC & POWER CO. has filed with the West Virginia Public Service Commission a new schedule of rates which would reduce by $49,000 the cost of power service to customers in four southern West Virginia counties. Rates to 5,634 residential consumers will be reduced by $24,000 and to 941 consumers in three general classifications by $25,000. Virginia Electric & Power operates in parts of Greenbrier, Monroe, Summers and Pocahontas counties in West Virginia.

PRAIRIE POWER COOPERATIVE INC., in Camas County, Idaho, is preparing plans for its first reduction of rates, according to George Perkins, Jr., manager. Directors are planning a reduction that will lower the rates approximately 15 percent, providing an average saving of 75 cents per member per month.

ELLICOTTVILLE ELECTRIC LIGHT CO. has reduced its electric rates in the village of Ellicottville and portions of the town of Ellicottville and Great Valley, Cattaraugus County, New York. The reduction is estimated at $2,000 per annum and is to become effective June 1, 1946.

•

Recent Legislation

Several measures, affecting the public utility industry, have been signed by Governor Dewey of New York. The bills include:

Dwyer bill as chapter 804 laws of 1946, amending the administrative code of the City of New York to permit the use of the waters in the up-state water supply belonging to New York City for the generation of electric energy. Under the provisions of the new law, the city of New York may grant or lease to an electric corporation for periods not to exceed 50 years rights in and to use the lands and waters of the city of New York for the generation of electric energy.

Wicks bill as chapter 620 laws of 1946, amending ¶ 53-a Public Health Law to provide sanitary control of New York City water supply board shall not extend beyond sources of potable water supply tributary to Delaware aqueduct and that water supply, gas and electricity commissioner and water supply board shall not have or exercise concurrent powers or sanitary control over any source of potable water supply tributary to such aqueduct.

Young bill as chapter 778 laws of 1946, amending ¶ 465 Conservation Law to provide all revenues of river regulating boards shall be deposited in bank at Albany or within regulating district; authorizes comptroller to pay from debt service fund principal and interest of obligations; permits board to invest moneys in general fund in United States and state obligations which shall be delivered to comptroller for custody.

Lawrence Bill as chapter 377 laws of 1946 to repeal section 60-c Conservation Law authorizing conservation commissioner to permit construction by government agency of power transmission lines, roads, highways and airway beacons through state lands for national defense.

McMullen bill as chapter 830 of the laws of 1946 to amend the Public Service Law, authorizing public service commission to refund fees or other charges in excess of amount legally chargeable against any person, firm, corporation or municipal corporation within three years after date of payment.

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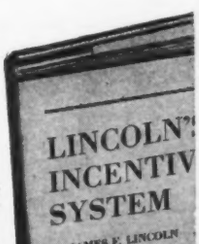

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REA Announces New Allotments

The Rural Electrification Administration has recently approved loans totaling $12,816,000 to 50 cooperatives in 24 states. The funds will be used to finance construction to provide electric service to farms and other rural establishments. Construction will proceed as rapidly as materials and manpower can be obtained.

Details of the allotments include:

ALABAMA — Clarke - Washington Electric Membership Corp., Jackson, $655,000; Southern Pine Electric Cooperative, Brewton, $510,000.

ARKANSAS—Craighead Electric Cooperative Corp., Jonesboro, $580,500; Ozarks Rural Electric Cooperative, Fayetteville, $150,000.

COLORADO—White River Electric Assn., Meeker, $410,000.

GEORGIA—Jefferson County Electric Membership Corp., Louisville, $50,000; Planters Electric Membership Corp., Millen, $50,000; Tri-County Electric Membership Corp., Gray, $50,000.

IDAHO—Idaho County Light and Power Cooperative Assn., Grangeville, $183,000.

ILLINOIS—Coles-Moultrie Electric Cooperative, Mattoon, $265,000; M.J.M. Electric Cooperative, Inc., Carlinville, $180,000.

INDIANA—Wayne County Rural Electric Membership Corp., Richmond, $115,000; Wabash County Rural Electric Membership Corp., Wabash, $80,000.

KANSAS—CMS Electric Cooperative, Meade $26,000.

LOUISIANA—Southwest Louisiana Electric Membership Corp., Lafayette, $108,000; Washington-St. Tammany Electric Cooperative, Franklinton, $103,000.

MICHIGAN—Fruit Belt Electric Cooperative, Cassopolis, $323,000.

MINNESOTA — Todd - Wadena Power & Light Cooperative Assn., Wadena, $285,000.

MISSISSIPPI—Northeast Mississippi Electric Power Assn., Oxford, $500,000.

MISSOURI—Co-Mo Electric Cooperative, Inc., Tipton, $323,000; Ozark Electric Cooperative, Mt. Vernon, Mo., $302,000; Callaway County Electric Cooperative Assn., Fulton, $285,000; Grundy Electric Cooperative, Inc., Trenton, $252,000; Three Rivers Electric Cooperative, Linn, $218,000; Howard County Electric Cooperative Assn., Fayette, $105,000.

MONTANA—Hill County Electric Cooperative, Havre, $585,000; Sheridan County Electric Cooperative, Inc., Westby, $50,000.

NEBRASKA—McCook Public Power District, McCook, $300,000.

NORTH CAROLINA—Wake Electric Membership Corp., Wake Forest, $319,000; Halifax Electric Membership Corp., Enfield, $225,000.

NORTH DAKOTA—Burke-Divide Electric Cooperative, Inc., Bowbells, $600,000.

OKLAHOMA—Oklahoma Electric Cooperative, Norman, $264,000; Kay Electric Cooperative, Blackwell, $263,000; Southwest Rural Electric Assn., Inc., Tipton, $229,000.

PENNSYLVANIA—Claverack Electric Cooperative, Inc., Towanda, $70,000.

SOUTH DAKOTA — Bon Homme - Yankton Electric Assn., Tabor, $515,000; Whetstone Valley Electric Assn., Milbank, $405,000.

TENNESSEE—Lincoln County Electric Membership Corp., Fayetteville, $603,000; Pickwick Electric Membership Corp., Selmer, $570,000; Meriwether-Lewis Electric Cooperative, Centerville, $376,000.

VIRGINIA—Shenandoah Valley Electric Cooperative, Dayton, $840,000.

WISCONSIN—Vernon Electric Cooperative, Westby, $130,000; Head of the Lakes Cooperative Electric Assn., Superior, $65,000.

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